§ 75.1909. This scheme was consistent with the recommendations of the Diesel Advisory Committee. Nonpermissible equipment that did not meet the criteria of the limited class would have been subject to fully assembled machine approval under subpart I of part 7, and would also have been required to be equipped with a power package approved under subpart G of part 7. Power packages provide the equipment with safety features such as surface temperature controls, exhaust temperature controls, and safety shutdown capability.

Although the proposal anticipated fully assembled machine approval of both permissible and nonpermissible diesel-powered equipment, MSHA specifically solicited comments on whether nonpermissible diesel-powered equipment should be approved by MSHA in an advance notice of proposed rulemaking published on the same day as the proposed rule. Many commenters to the proposal and to the advance notice were strongly opposed to fully assembled machine approval for nonpermissible equipment, stating that it was neither necessary for safety nor consistent with MSHA's approach to electrical equipment. These commenters stated that approval of nonpermissible diesel equipment would create significant technical hurdles and place unnecessary financial burdens on mine operators, without any justification from a safety perspective. These commenters recommended that the final rule set performance-oriented safety requirements for nonpermissible equipment in mandatory standards in part 75, and that the safety features that were proposed for the limited class of light-duty equipment in § 75.1909 be applied to all nonpermissible equipment.

Many commenters were also opposed to the proposed requirement that most nonpermissible equipment have a power package approved under subpart F or G of part 7. Commenters stated that the protections afforded by a power package were unnecessary for equipment operated in areas of the mine where methane is not likely to accumulate, and that much of the nonpermissible diesel-powered equipment currently in use would have to be either scrapped or significantly retrofitted to comply with the proposed requirements, at tremendous expense. Several commenters pointed out that it would be impossible to retrofit some types of equipment because of design limitations.

Other commenters supported full machine approval and power packages for all nonpermissible equipment, and further recommended that all diesel-powered equipment in underground mines be permissible and equipped with the explosion-proof equipment features required in areas of the mine where coal is extracted and where higher methane levels are a concern.

The final rule responds to commenters opposed to full machine approval for nonpermissible equipment, and does not adopt the proposed requirement for power packages on most nonpermissible equipment. It should be noted, however, that all nonpermissible equipment, with the exception of emergency equipment under § 75.1908(d), is required to have an engine approved under subpart E of part 7.

In evaluating whether an approval program for nonpermissible diesel-powered equipment was warranted in the final rule, MSHA considered whether the machine safety features set forth in proposed § 75.1909 for the limited class of light-duty equipment could be modified to provide adequate protection for heavy-duty equipment. This review revealed that many requirements in proposed § 75.1909 could be applied directly to heavy-duty equipment without revision, while other proposed requirements could be made suitable with slight revisions.

The safety features proposed in § 75.1909 for limited class equipment have been adopted in the final rule in §§ 75.1909 and 75.1910 to cover equipment that is larger and more powerful than what would have been covered under the proposed rule. This is in response to a number of commenters who believed that these proposed requirements should be applied to both heavy-duty and light-duty equipment, in lieu of a full machine approval program. In general, the proposed requirements have not been substantially changed in the final rule, although the final rule does adopt several additional requirements for heavy-duty equipment based on requirements in part 36 or developed from existing part 75 requirements applicable to electric-powered machines. Other additions or revisions have been made in response to comments received on proposed § 75.1909 and in response to the advance notice of proposed rulemaking.

Section 75.1909 Nonpermissible Diesel-Powered Equipment—Design and Performance Requirements

Section 75.1909 establishes design and performance requirements for diesel-powered equipment used where nonpermissible electric equipment is permitted, with the exception of the special category of equipment under § 75.1908(d). The requirements of this section are consistent with the recommendation of the Advisory Committee that such equipment be provided with fire suppression system and fuel and electrical system protection. All nonpermissible equipment, with the exception of the special category of emergency equipment under § 75.1908(d), is also required to be provided with an approved engine within the time frames established in § 75.1907 of the final rule.

Paragraph (a)(1), like the proposal, requires that nonpermissible diesel-powered equipment be equipped with an engine approved under subpart E of part 7. The final rule also requires that the engine be equipped with an air filter and an air filter service indicator. The air filter must be sized and the service indicator set in accordance with the engine manufacturer's recommendations.

Some commenters stated that approved engines were not necessary on outby equipment. Other commenters recommended that all equipment used in outby areas be provided not only with an approved engine, but also with a permissible power package approved under subpart F of part 7.

The final rule adopts the proposed requirement that nonpermissible equipment be provided with an approved engine. Engines approved under subpart E of part 7 must meet specific gaseous emission standards and be provided with an approval plate indicating the quantity of ventilating air needed to dilute gaseous contaminants to acceptable levels. These requirements not only place limits on the quantity of gaseous contaminants that an approved engine may produce, they also provide a scheme for control of those contaminants through effective ventilation. Commenters expressed serious concern over unhealthful exhaust emissions from diesel equipment in outby areas that may significantly affect the quality of air that miners breathe. In response to these concerns, the final rule takes a comprehensive approach in addressing health hazards presented by diesel exhaust, and requires clean-burning engines, approved by MSHA under subpart E of part 7, on all diesel-powered machines, including nonpermissible equipment. Engines installed in this equipment must therefore meet the emissions standards established in subpart E of part 7.

The final rule does not adopt the suggestion of commenters who supported requiring all diesel equipment in underground coal mines

to be permissible. The explosion- proof features provided by a subpart F power package are not needed for outby equipment, because the equipment operates in areas of the mine where methane is not expected to accumulate. Electrical equipment without explosion-proof features has been operated safely in outby locations for many years.

The requirement that the engine be equipped with an air filter and an air filter service indicator has been added in response to commenters'' statements that clogged air filters were the single most frequent cause of smoky engines, resulting in the production of disproportionate quantities of carbon monoxide and diesel particulate. These components are typically supplied as part of the equipment, and the air filter service indicator will enable the equipment operator and maintenance personnel to ensure that the air filter is in good condition. Both the size of the air filter and the setting of the air filter service indicator are best determined by the engine manufacturer, and the final rule requires that these be determined in accordance with the engine manufacturer's recommendations.

Paragraph (a)(2) has been added to the final rule and requires that nonpermissible equipment be provided with at least one portable multipurpose dry chemical type (ABC) fire extinguisher, listed or approved by a nationally recognized independent testing laboratory, and having a 10A:60B:C or higher rating. The extinguisher must be located within easy reach of the equipment operator and be protected from damage. This requirement has been added to the final rule in response to a commenter who supported requiring two chemical fire extinguishers accessible to each end of the unit and protected from external damage. MSHA agrees with this recommendation, which is consistent with good fire prevention practices and which will provide additional fire protection on diesel-powered machines. One rather than two fire extinguishers has been required, however, because one extinguisher, accessible to the operator and protected from damage, is adequate for virtually all diesel-powered equipment. As discussed elsewhere in the preamble, this equipment is also required to be equipped with either an automatic or manual fire suppression system, depending on the equipment category.

Paragraph (a)(3) has been adopted from the proposal, and requires that the equipment's fuel system be specifically designed for diesel fuel, and that it meet specific additional criteria. One commenter recommended that this provision be revised to require a fuel system ''specifically designed and constructed to minimize the possibility of a fire in case of a collision or refueling''. The commenter stated that fuel tanks on most light-duty equipment, such as pickup trucks, already meet certain standards, and that it would be unwise from a safety standpoint to modify these tanks. The final rule has not been revised in response to this comment. The fuel system requirements in the final rule are designed to address safety hazards presented by the use of diesel equipment in the underground mine environment, and nonspecific concerns about retrofitting equipment do not outweigh the protections afforded by the fuel system criteria included in the final rule. However, a fuel system that meets applicable industry standards would be acceptable so long as it also meets the criteria in paragraphs (a)(3)(i) through (xi).

Paragraph (a)(3)(i) provides that the fuel system must have a fuel tank and fuel lines that do not leak. The proposed rule, unlike the final rule, would have required that the fuel tank be of ''leakproof construction.'' Several commenters stated that the term ''leakproof construction'' was ambiguous and needed to be defined in the final rule, or be revised to provide for construction that was ''designed to prevent leaks''. Rather than providing a definition for ''leakproof construction'' and specifying design or construction requirements to protect against leakage, the final rule sets a performance standard and simply requires that the fuel tank and fuel lines not leak, allowing mine operators the flexibility to determine how to best comply with this requirement. Fuel lines have been included in this requirement under the final rule, in response to commenters who were concerned about fire hazards presented by leaking fuel lines on diesel-powered equipment coming into contact with hot engine surfaces.

Paragraph (a)(3)(ii) adopts the proposed requirement that the fuel tank be substantially constructed and protected against damage by collision. Commenters generally supported this requirement. The tank may be protected from damage by collision by being located within the frame components of the machine, or be constructed of material that is sufficiently sturdy so that the tank will not be damaged by collision with other vehicles or with the mine roof, rib, or floor. It should be noted that although the term ''tank'' is used in the singular here and in other paragraphs of this section, the final rule is not intended to limit the number of tanks on equipment. Several models of pickup trucks are manufactured with dual fuel tanks, and this configuration is acceptable under the final rule.

Paragraph (a)(3)(iii) requires that the fuel system be provided with a vent opening that maintains atmospheric pressure in the tank, and which is designed to prevent fuel from splashing out. The proposed rule would have required that the size of the vent prevent fuel from splashing out of the vent opening. This requirement has been modified slightly in the final rule to specify that the design rather than the size of the vent opening must prevent fuel from splashing out, in response to commenters who advocated requirements that were more performance-oriented. This minor revision will allow mine operators increased flexibility in satisfying this requirement. MSHA anticipates that the vent provided in the fuel filler cap will satisfy this requirement.

Paragraph (a)(3)(iv) requires a self-closing filler cap on the fuel tank. The proposed rule would have required either a tethered cap or a self-closing cap. The final rule requires a self-closing fuel cap that will serve to minimize fuel spillage, and responds to commenters'' serious concerns about the hazards of fuel spillage.

Paragraph (a)(3)(v) requires that the fuel tank, filler and vent be located so that any leaks or spillage during refueling will not contact hot surfaces. This requirement has been revised from the proposed rule, which would have required that these components be located to prevent fuel from contacting hot engine surfaces. The final rule has been revised from the proposal because of the application of the requirements of this section to all nonpermissible diesel-powered equipment, not just equipment falling in the proposed limited class. This modification recognizes that there are additional machine components, particularly on larger heavy-duty equipment, now falling under this requirement that reach temperatures that could ignite diesel fuel. For example, brake components can reach temperatures that are as high as engine temperatures.

Paragraph (a)(3)(vi) requires that fuel line piping be either: steel-wire reinforced; synthetic elastomer-covered hose suitable for use with diesel fuel that has been tested and has been determined to be fire-resistant by the manufacturer; or metal. The proposal would have required metal fuel line piping. Several commenters stated that requiring fuel line piping to be made of metal was too restrictive. Several of these commenters stated that metal fuel

lines could deteriorate over time as a result of machine vibration, and that there were fuel lines made of other materials that were superior in strength and performance to metal lines. The final rule has been revised from the proposal to address these concerns. Synthetic elastomer-covered hose must be of a type that is suitable for use with diesel fuel, and must have been tested and determined to be fire-resistant by the manufacturer, using any one of a number of fire-resistance tests. Such tests have been developed by a number of organizations, including Underwriters Laboratories, The Society of Automotive Engineers, and the U.S. Coast Guard. MSHA's tests for flame-resistance specified in regulations at part 18 would also be appropriate. This will ensure that material used for diesel fuel lines will have adequate fire-resistance in the underground coal mine environment.

Paragraph (a)(3)(vii) adopts the proposed requirement that fuel line piping be clamped. One commenter stated that this requirement, along with the requirement that primary fuel lines be located so that fuel line leaks do not contact hot surfaces, would limit machine design flexibility. This commenter recommended that these requirements be revised to provide that the manufacturer's design provide maximum protection from damage. The final rule does not adopt this suggestion. The requirements identified by the commenter are intended to address potential hazards on diesel equipment, particularly fire hazards. The fact that there may be some resulting limitations on machine design, alone, does not warrant the elimination of requirements that address specific hazards.

Paragraph (a)(3)(viii), like the proposal, requires primary fuel lines to be located such that leaks do not contact hot surfaces. The fuel lines referred to in this paragraph are the supply and return lines connecting the fuel tank to the engine, not those lines that are integral to the engine and installed by the engine manufacturer, such as the lines connecting the injector pump to the injectors. Several commenters supported this requirement, pointing to the potential for fire resulting from leaking fuel dripping on hot exhaust components. One commenter recommended that the engine be designed to shut down in the event of a leaking fuel line. This comment has not been adopted in the final rule, in part because MSHA is unaware of any existing technology that would provide such a function. Additionally, such a requirement is not necessary, given the fuel system design criteria under this section in conjunction with the weekly equipment inspections required by § 75.1914 of the final rule. These requirements together adequately address the potential hazard created by leaking fuel lines.

Paragraph (a)(3)(ix) requires fuel lines to be separated from electrical wiring and protected from damage in ordinary use. This requirement has been adopted from the proposal, and was supported by several commenters, who mentioned incidents where fuel lines were exposed to damage. Separation of fuel and electrical lines can generally be easily accomplished. On machines where both electrical lines and fuel lines are routed through a machine articulation joint, fuel lines must be bundled separately from electrical lines and must be positioned so that fuel leaks will not contact electrical lines.

Paragraph (a)(3)(x) requires that a manual shutoff valve be installed in the fuel system as close as practicable to the tank. The language of the final rule has been modified from the proposal, which would have required the valve to be located ''near'' the tank. This change is made in response to a commenter who stated that valves located ''near'' the tank would not necessarily be easily accessible to the equipment operator or other mine personnel when the fuel supply needs to be shut off in an emergency or for maintenance. The commenter recommended that this aspect of the proposal be revised to require shutoff valves as close as practicable to the tank, and the final rule adopts this comment.

Paragraph (a)(3)(xi) adopts the proposed requirement that equipment be provided with fuel filter(s) and a water separator. The final rule substitutes the term ''water separator'' for the term ''water strainer'' used in the proposal. The terms mean the same thing, but ''water separator'' is more commonly used and more widely understood. Although commenters generally supported this requirement, one commenter stated this requirement should be eliminated because fuel filters and water separators were not necessary. MSHA disagrees with this commenter, and the proposed requirement has been included in the final rule. Fuel filters filter out particulate matter in fuel, thereby reducing diesel exhaust emissions as well as slowing engine wear. Water separators filter out water in the fuel, and minimize fuel system corrosion. Several commenters recommended that the proposed requirement be revised to permit the use of a single device that functions as both a fuel filter and a water separator. Such combination devices will satisfy the requirements of this section. The final rule has not been revised, however, because the language as proposed and as adopted in the final rule does not preclude the use of a combination fuel filter/water separator.

The proposed requirement for a fuel tank drain plug has not been adopted in the final rule. Although the drain plug is usually provided on larger mining equipment, it is typically not provided on light-duty equipment such as pickup trucks. Although a drain plug is a convenient feature for persons performing equipment maintenance, it is not necessary from a strict safety standpoint. For these reasons, a fuel tank drain plug is not required under the final rule.

Paragraph (a)(4) adopts the requirement of the proposal for a sensor to monitor the temperature and provide a visual warning of an overheated cylinder head on air-cooled engines. This feature is necessary because it reduces potential fire hazards on air-cooled engines. While such sensors do not completely eliminate the hazards of hot surface temperatures, they do provide additional protection by warning the equipment operator of overheating. The proposed rule would have required a temperature sensor to be located in the engine compartment that would automatically activate an intake air shutdown device to stop the engine before the engine compartment temperature exceeded the actuation temperature of the fire suppression system. This requirement has not been adopted in the final rule. Although commenters generally supported the concept behind this requirement, they had varied concerns about its application and impracticality from a technological standpoint. One commenter stated that this requirement could create a safety hazard because the engine could be shut off unexpectedly. Since loss of steering and braking could result, this commenter recommended that the engine be shut off only upon actuation of the fire suppression system. Several commenters stated that use of manual fire suppression systems on equipment was incompatible with this requirement.

MSHA agrees that this proposed requirement could have resulted in the equipment losing control of the machine in the case of unexpected engine shutdown, and the engine should only be shut down upon actuation of the fire suppression system. The automatic engine shutdown under the proposal would have been triggered before the engine temperature exceeded the actuation temperature of the fire suppression system. Section 75.1911(d)

of the final rule already requires fire suppression systems for diesel-powered equipment to provide for automatic engine shutdown, and a redundant requirement for automatic engine shutdown at a lower temperature is not necessary. An increase in the engine compartment temperature may reflect an engine malfunction, such as loss of engine coolant, but does not necessarily indicate a safety hazard. Linking engine shutdown to the engine compartment temperature would have provided protection against engine damage rather than addressing a discrete safety hazard. Equipment manufacturers routinely provide gauges in the equipment operator's compartment that indicate engine faults. Equipment operators will be alerted by this warning system and will then be able to shut the engine down, if appropriate. For these reasons, the proposed requirement for automatic engine shutdown based on engine compartment temperature has not been adopted in the final rule.

Paragraph (a)(5) requires that guarding be provided to protect fuel, hydraulic, and electric lines when such lines pass near rotating parts and to protect the lines in the event of shaft failure. This requirement is intended to prevent leaks and short circuits caused by fuel, hydraulic, and electric lines abrading against rotating parts. Rotating parts include machine components such as pulleys, belts, fans, and shafts. This requirement is similar to that of the proposal, although the proposed rule had specified that ''adequate guarding'' be provided and did not include protection for hydraulic lines or protection in case of shaft failure. The word ''adequate'' is redundant in this context and has not been adopted in the final rule. The reference to ''hydraulic lines'' was not included in the proposal because no hydraulic systems were permitted on the limited class of equipment for which the requirement was proposed. Under the final rule these requirements apply to larger equipment with hydraulic systems, and protection for hydraulic lines has therefore been added. Guarding to protect against shaft failure has also been added to the final rule to address the design features of the larger equipment now governed by these requirements. MSHA has received reports of several fires ignited by broken shafts that damaged hydraulic and electrical lines.

One commenter supported this requirement, while another commenter believed that it was unnecessary. A third commenter recommended that the engine compartment be shielded by metal from hydraulic components. Protection for fuel, hydraulic, and electrical lines is an essential element in preventing fires. The final rule does not specify what method must be used to comply with this requirement, because a number of different methods, including guarding, shielding as recommended by the commenter, or relocation of fuel, hydraulic or electrical lines, can provide adequate protection.

Paragraph (a)(6) has been added to the final rule and requires that hydraulic tanks, fillers, vents, and lines be located so that any spillage or leaks will not contact hot surfaces. This requirement has been added to the final rule to supplement the guarding of hydraulic lines in paragraph (a)(5) and is supported by the Ontario fire accident data, which show that leaking hydraulic lines contribute to fires. This requirement was not included in the proposal because, as explained in the discussion of paragraph (a)(5), hydraulic systems would not have been permitted on the limited class of light-duty equipment to which the requirement would have applied under the proposal. This requirement will ensure that spills and leaks of combustible hydraulic fluid do not contact hot equipment surfaces. This requirement can be satisfied by relocation of machine components, or by directing spills and leaks away from hot surfaces by means of splash guards or other such devices.

Paragraph (a)(7) requires that reflectors or warning lights which can be readily seen in all directions be mounted on equipment. This requirement was generally supported by commenters and is adopted unchanged from the proposal. A determination of whether the reflectors or warning lights can be ''readily seen'' must be based on the unique mine conditions, and must take into account such things as equipment size in relation to the mine entry and undulating mine terrain.

Paragraph (a)(8) has been added to the final rule in response to comments, and requires that a means be installed on the equipment to direct exhaust gas away from the equipment operator and persons on board the machine. This requirement is intended to provide for the discharge of exhaust gases away from persons on the machine to the greatest extent practicable, minimizing their exposure to excessive levels of unhealthful diesel exhaust contaminants. The exhaust pipe must direct the flow away from any area where a machine operator or a passenger could be located. Exhaust pipes that extend straight up and that would allow the exhaust to flow back over the equipment operator as the machine moves forward, such as on some agricultural and commercial equipment, are unacceptable under the final rule. This requirement is added to the final rule in response to the recommendation of two commenters, one of whom noted that exhaust gases can build up in the operator's compartment of a machine.

Paragraph (a)(9) has been added to the final rule in response to a commenter and as a result of the expansion of the class of equipment subject to the requirements of this section. This paragraph requires that a means be provided to prevent unintentional free and uncontrolled descent of personnel-elevating work platforms. Personnel-elevating work platforms normally are equipped with hydraulic systems and would consequently not have been eligible for inclusion in the category of limited class equipment under the proposed rule. This requirement is currently applied to equipment approved under existing part 36. Hydraulically operated personnel-elevating platforms meeting the applicable American National Standards Institute criteria for personnel-elevating platforms (i.e., ANSI A92.2 and A.92.5) would be acceptable. This requirement also applies to work platforms which utilize other methods to raise the platform, such as wire ropes. The machine must be provided with a specific feature that prevents the free and uncontrolled descent of the platform in the event of a failure in the lifting system, such as a ruptured hydraulic hose or broken wire rope. In such a situation, the platform must descend at a rate which will not endanger miners located on or below the platform.

Paragraph (a)(10) has been added to the final rule and requires that all nonpermissible equipment be provided with a means to prevent the spray from ruptured hydraulic or lubricating oil lines from being ignited by contact with engine exhaust system component surfaces. This requirement achieves the goal of the limitation of surface temperatures in proposed subpart G of part 7, which is not adopted in the final rule, and recognizes that high surface temperatures on diesel-powered equipment can be controlled in ways other than the water-jacketing of hot engine components contemplated under proposed subpart G. The requirement of this paragraph, in conjunction with other requirements in the final rule for control of fuel sources on diesel-powered machines, will provide effective fire prevention on nonpermissible diesel-powered equipment used underground.

The requirements of this paragraph are performance-oriented, and are

intended not only to allow flexibility in compliance but also to accommodate new technology developed in the future. One method of achieving compliance with this requirement is through the use of a water-cooled manifold. A safety component system certified under part 36 or a power package approved under subpart F of part 7 of the final rule also satisfies the requirement of this paragraph.

Non-absorbent insulating materials are also available for use on mining equipment to reduce the surface temperature of diesel exhaust system components. Such materials, which were first developed for diesel-powered military vehicles, are impervious to hydraulic fluid, lubricating fluids, and diesel fuel, and have been successfully used on mining equipment in the United States and Canada. Use of these materials can reduce surface temperatures of exhaust components to less than 300 °F, and may also be used to prevent contact of hydraulic fluid and lubricating oil with hot surfaces. The goal of applying the insulating material is to substantially reduce the surface area of the exhaust system that is at elevated temperatures, because of the direct relationship between the area of a hot surface and the likelihood of ignition of a spray of hydraulic fluid. A large area of exhaust component, which includes the turbocharger, at a high temperature is more likely to ignite a spray.

The use of shielding or partitions to isolate hydraulic components from the engine would also satisfy the requirement of this paragraph, preventing the fluid from contacting the engine in the event of a leak. One commenter retrofitted a diesel-powered machine to provide shielding of the engine.

Paragraph (b) sets forth additional requirements for self-propelled nonpermissible diesel-powered equipment, which are specifically designed for equipment that moves under its own power, as opposed to equipment that is towed. Paragraph (b)(1) has been added to the final rule and requires a means to ensure that no stored hydraulic energy that will cause machine articulation is available after the engine is shut down. As discussed elsewhere in the preamble, requirements relating to hydraulic systems were not included in the proposal because the affected equipment could not have hydraulic systems. This requirement is intended to eliminate accidents where an equipment operator inadvertently activates the steering controls on articulated vehicles when entering or exiting the operator's compartment. In many articulated machine designs, personnel must enter the equipment operator's compartment through the articulation area. If the articulation joint were to close as the operator entered the compartment, the operator could be crushed. This requirement will also protect miners who encounter a machine that has been shut down and who may accidentally activate the control levers. Under the final rule, the stored hydraulic energy does not have to be dissipated instantly. The time permitted for dissipation of the stored energy will depend on the machine design and the amount of movement the machine is capable of after shutdown.

Paragraph (b)(2) has been added to the final rule in response to a specific comment that equipment should only be able to start in neutral. This paragraph requires equipment to be provided with a neutral start feature which ensures that engine cranking torque will not be transmitted through the powertrain and cause machine movement on vehicles utilizing fluid power transmissions. MSHA agrees with the commenter that this requirement is necessary, because some types of diesel-powered equipment may be started with the transmission in gear. This could result in power being delivered to the driving wheels of the machine before the equipment operator is in control of the vehicle, endangering both the operator and miners working in the vicinity of the equipment. Equipment must be designed such that its transmission is in either neutral or park before the starter will crank the engine.

For machines with steering wheels, brake pedals, and accelerator pedals, paragraph (b)(3) requires that the controls be arranged consistent with standard automobile orientation. This requirement has been added in response to a commenter who was concerned that equipment operators could become confused in the operation of equipment controls. Under this paragraph the brake pedal must be on the left and the accelerator must be on the right when the operator is facing the controls. Clockwise rotation of the steering wheel must turn the machine to the right, and counter-clockwise rotation of the steering wheel must turn the machine to the left. For machines with seating perpendicular to the direction of travel, the forward direction of travel and the automobile orientation of the controls are to be defined with respect to the front end of the equipment. For machines where the operator changes seats depending on the direction of travel, the machine control movements should also change accordingly, to retain the automobile orientation.

Paragraph (b)(4), like the proposal, requires self-propelled equipment to be provided with an audible warning device conveniently located near the operator. Such a device could be a horn or bell, and must be capable of being heard over the operation of the machine by miners in the area. Commenters were generally supportive of this provision.

Paragraph (b)(5) requires that lights be provided and maintained on both ends of the equipment. Equipment normally operated in both directions must be equipped with headlights for both directions. The proposal would have required self-propelled equipment to be provided with headlights, tail lights, and back-up lights. The requirement in the final rule is derived from the proposal but has been revised to better address typical lighting configurations on all types of nonpermissible equipment, not only the limited class of equipment that would have been affected under the proposal. For equipment such as ramcars, headlights on each end of the machine would be required, but not tail lights or back-up lights. For pickup trucks, headlights and back-up lights installed as original equipment would satisfy this requirement. The lights required by this paragraph are in addition to the warning lights or reflectors required by paragraph (a)(7) of this section.

Under the proposal lights would have been required to be ''protected from accidental damage''. The final rule requires instead that lights be ''maintained'', in response to a commenter who questioned what was meant by ''protected from accidental damage.'' Under the final rule equipment lights must be kept in working order, and replaced if they burn out or are damaged.

Although most commenters generally agreed with the proposed requirement, one commenter supported a requirement for back-up alarms or other means to alert miners to a change in the direction that equipment is moving. Although a back-up alarm may be appropriate on some equipment, an alarm on equipment that normally operates in both directions is not advisable because the alarm would be set off on a regular basis, defeating its effectiveness as a warning system. This suggestion has therefore not been adopted in the final rule.

Paragraph (b)(5) also requires equipment that normally operates in both directions to be equipped with headlights for both directions. One commenter recommended that lights be designed for operation in both

directions at once. This commenter noted that normally the light switch allows the lights to be on in only one direction and that it would be beneficial to observe the load while traveling in the other direction. Although this feature may be appropriate under some circumstances, it would provide no significant safety benefit and is not warranted for inclusion as a general machine feature. In many mines, the fact that lights are illuminated in only one direction at a time allows other miners in the vicinity to determine the equipment's direction of movement and provides some safety benefit. Illumination of both sets of lights at the same time would eliminate this capability, and this suggestion has therefore not been adopted in the final rule.

Paragraph (b)(6) requires that self-propelled nonpermissible equipment be provided with service brakes that act on each wheel of the vehicle and that are designed such that failure of any single component, except the brake pedal or similar actuation device, does not result in a complete loss of service braking capability. This paragraph requires two separate brake systems and ensures that, in the event of the failure of one braking system, the other system can bring the machine to a controlled stop. The only common component permitted in the two systems is the brake pedal or a similar device, such as a lever or button that is actuated by the equipment operator. This requirement has been adopted from the proposal with slight revisions to specify that the service brakes ''act on each wheel'' instead of ''for each wheel''. This will allow the use of axle brakes, which act on all of the wheels on that axle. This requirement prohibits drive line brakes in which failure of a single drive shaft or chain results in the loss of all braking capability. A split brake system with two completely independent hydraulic circuits with an automotive-type dual piston master cylinder complies with this requirement.

The proposal provided that failure of one ''brake line'' must not result in a complete loss of service braking capability. This language has been changed to provide that failure of any ''single component'' must not result in a complete loss of service braking capability, to conform the requirement to the expanded range of equipment that is governed by this requirement under the final rule.

The brake pedal or other interface between the equipment operator and the braking system is excluded from this requirement. If the pedal is connected to more than one link to activate the brake systems, those links must provide for independent actuation of the brake systems in the event of the failure of one of the links. Drive line brakes are not adequate because of the frequent failure of universal joints. The failure of the universal joint could result in the loss of all braking ability if a second brake system is not provided. Most agricultural equipment and some commercial equipment used in mines, such as high lifts or backhoes, may need a retrofit of their braking systems to comply with this requirement.

Several commenters supported this requirement and recommended two braking systems independent of each other in all working aspects. Other commenters noted that a single brake system would be adequate for tractor-type vehicles because they travel at speeds of less than 15 mph. MSHA disagrees that the low speeds of this type of equipment eliminates the need for two brake systems. Failure of an equipment's brake system in the confined area of an underground coal mine could result in serious injury or death, even at speeds of 15 mph or less. The final rule therefore does not incorporate this comment. Other commenters were of the opinion that the brake systems should not be separate for each wheel. This recommendation has been incorporated into the language of the final rule.

Paragraph (b)(7) has been adopted unchanged from the proposal and requires self-propelled nonpermissible equipment to be provided with service brakes that can safely bring the fully loaded vehicle to a complete stop on the maximum grade on which it is operated. No stopping distance or braking force is specified in the final rule, to allow flexibility in equipment design and usage. Compliance with this requirement is highly site-dependent because of the variation in mine grades. The mine operator is responsible for ensuring that equipment with adequate grade-holding ability is used at a particular location. Commenters generally supported this requirement.

Paragraph (b)(8) has been added to the final rule and requires that no device that traps a column of fluid to hold the brake in the applied position be installed in any brake system, unless the trapped column of fluid is released when the operator is no longer in contact with the brake activation device. This requirement prohibits the installation of ''park'' brakes devices which rely on a trapped column of fluid, and has been included in response to the suggestion of commenters. The use of such devices can present serious hazards, and are prohibited. Because the temperature of hydraulic brake fluid increases due to usage, a column of fluid trapped at a sufficient pressure will initially apply the brakes sufficiently to hold the machine stationary. However, as the fluid cools it contracts, lowering the pressure and possibly releasing the brakes. These devices are not permitted even as supplemental devices, because of the risk that equipment operators would use them as park brakes even if another park brake is provided. Several fatal accidents have been attributed to use of these devices, also called ''mico lock braking systems''.

This requirement does not apply to normal automotive-type service brakes which trap a column of fluid, as long as the operator is applying pressure to the foot pedal. This requirement also does not preclude the use of hydrostatic drive wheel motors that are designed and maintained to function as service brakes. These wheel motors do not necessarily lose their service braking ability if the fluid cools or if minimal leakage occurs. The wheel motors can act to maintain continuous pressure in the braking circuit. Although hydrostatic wheel motors can function as adequate service brakes, these systems do not provide adequate parking brake capability. For the wheel motor to maintain pressure in the braking circuit, the wheel must turn slightly, thereby permitting the machine to move very slowly down the grade. This movement is insignificant during the short period of time the service brakes are applied. However, if wheel motors are used as parking brakes, the machine can move a significant distance when the equipment operator is away from the machine. This can endanger miners who may be working near the machine in the confined area of the mine.

Paragraph (c) has been added to this section of the final rule to specifically address self-propelled nonpermissible heavy-duty diesel-powered equipment meeting the requirements of § 75.1908(a), except rail-mounted equipment. These requirements have been added to the final rule in response to the additional types of equipment that are now subject to the requirements of this section. Heavy-duty equipment that hauls rock, coal, or longwall components or transports large quantities of diesel fuel are governed by these safety requirements, and must be provided with a supplemental braking system that meets specified criteria. The criteria for these braking systems were developed from the criteria contained in § 75.523–3, applicable to automatic emergency parking brakes on similar

types of electrical equipment. There was widespread support for applying these braking requirements to diesel-powered equipment, in comments submitted in response to the advance notice of proposed rulemaking addressing equipment approval and machine safety features. Although there was a difference of opinion among these commenters as far as whether these braking requirements should be incorporated as part of an equipment approval program, commenters did agree that they be included as machine features either in an approval program or as mandatory safety standards in part 75. Commenters also recommended that there should be separate brake requirements for rail-mounted equipment. The Agency agrees with these comments, and has concluded that existing brake requirements in §§ 75.1404 and 75.1404–1, which apply to both electric and diesel-powered rail-mounted equipment, provide sufficient protection. Rail-mounted equipment has therefore been specifically excluded from this requirement under the final rule.

Existing § 75.523–3 specifies different requirements for two types of electric-powered equipment: haulage equipment and all other equipment. Electric-powered haulage equipment is very similar in function to the heavy-duty diesel-powered equipment subject to this requirement. Paragraphs (c)(1) through (c)(5) of this section of the final rule closely track the brake system requirements for electric haulage equipment in existing § 75.523–3, with the exception of the requirement that the brake be engaged by an emergency deenergization device or panic bar. A panic bar is appropriate for only some types of permissible diesel-powered equipment, and will be addressed during the part 36 approval process. Panic bars are not required for nonpermissible diesel-powered equipment. Under the final rule, self-propelled nonpermissible heavy-duty diesel-powered equipment, except rail-mounted equipment, is required to have a supplemental braking system that: (1) Engages automatically within 5 seconds of shutdown of the engine; (2) safely brings the equipment when fully loaded to a complete stop on the maximum grade where it is operated; (3) holds the equipment stationary, despite any contraction of brake parts, exhaustion of any nonmechanical source of energy, or leakage; (4) releases only by a manual control that does not operate any equipment function; (5) has a means in the equipment operator's compartment to apply the brakes manually without the engine operating, and a means to release and reengage the brakes without the engine operating; and (6) has a means to ensure that the supplemental braking system is released before the equipment can be trammed, and is designed to ensure that the brake is fully released at all times when the equipment is trammed.

Paragraph (c)(6) has been added to the final rule and requires that the supplemental braking system have a means to ensure that the system is released before the equipment can be trammed. It further requires that the system be designed to ensure the brake is fully released at all times while the equipment is trammed. This requirement is added to the final rule to address the hazard of dragging brakes, which were the cause of numerous fires reported in the Ontario fire data analyzed by MSHA in response to a commenter's recommendation. Some manufacturers install a lever on the transmission gear selector to ensure that the supplemental brakes are released. This lever automatically releases the brake when the operator shifts the transmission into gear.

Paragraph (d) applies to self-propelled nonpermissible light-duty diesel-powered equipment meeting the requirements of § 75.1908(b), except rail-mounted equipment. This provision, which has been adopted from the proposal, requires that the equipment be provided with a parking brake that holds the fully loaded equipment stationary on the maximum grade on which it is operated despite any contraction of the brake parts, exhaustion of any nonmechanical source of energy or leakage. This requirement was developed from existing § 75.523–3(d), which addresses parking brakes for electric-powered equipment other than haulage equipment, which is similar to the equipment in the light-duty category under § 75.1908(b) of the final rule.

A parking brake meeting the requirements of paragraph (d), rather than the supplemental brake system required for heavy-duty equipment under paragraph (c), is adequate for light-duty equipment, which is typically used for transportation or moving of supplies on an intermittent basis.

Paragraph (e) has been added to the final rule as a result of the inclusion of requirements for supplemental and park brake systems under paragraphs (c) and (d) of this section. This paragraph requires that the supplemental and park brake systems required by paragraphs (c) and (d) be applied when the equipment operator is not at the controls of the equipment, except during movement of disabled equipment. This requirement was developed from existing § 75.523–3(e), and requires the machine operator to set the brakes when not at the controls. However, this provision is not intended to suggest that it would be a safe practice for the operator to apply the brake and leave the machine with the engine running.

Paragraph (f) has been added to the final rule as a result of MSHA's review of the Ontario fire data, and requires self-propelled personnel-elevating work platforms be provided with a means to ensure that the parking braking system is released before the equipment can be trammed, and that the platforms be designed to ensure the brake is fully released at all times while the equipment is trammed. MSHA's review of the Ontario fire data revealed a high number of personnel-elevating vehicle fires caused by dragging brakes. The final rule applies the same requirement to personnel-elevating vehicles in this paragraph as applies to self-propelled heavy-duty nonpermissible equipment under paragraph (c)(6).

Paragraph (g) has been added to the final rule and requires that any nonpermissible equipment that discharges its exhaust directly into a return air course be provided with a power package approved under subpart F of part 7. The basis for this requirement is the possibility that the return air course may contain high levels of methane, which could be drawn into the machine's exhaust system as it cools after engine shutdown. This creates the potential for ignition of the methane by the hot surfaces of the diesel engine. As a result, the final rule requires equipment which discharges its exhaust directly into the return to be furnished with the fire and explosion protection provided by a subpart F power package. Equipment without a subpart F power package must discharge its exhaust into intake air.

Under the proposed rule all nonpermissible equipment, with the exception of a limited class of light-duty equipment, would have been required to be equipped with a power package approved under either subpart F or G of part 7. Subpart F power packages are equipped with spark arresters and flame arresters, which significantly reduce the likelihood that equipment will ignite explosive levels of methane. Because the final rule does not require power packages on nonpermissible equipment, this requirement has been added to the final rule to ensure that nonpermissible equipment that discharges it exhaust directly into a return air course, which could contain explosive levels of

methane, will not create an explosion hazard.

Paragraph (h) requires that self-propelled nonpermissible heavy-duty equipment meeting the requirements of § 75.1908(a) be provided with an automatic fire suppression system meeting the requirements of § 75.1911. Paragraph (i) requires that self-propelled nonpermissible light-duty equipment meeting the requirements of § 75.1908(b) be provided with a manual or automatic fire suppression system meeting the requirements of § 75.1911. Under the proposed rule, all nonpermissible equipment would have been required to be provided with an automatic fire suppression system.

As explained in greater detail in the preamble discussion for § 75.1911 of the final rule, some commenters supported automatic fire suppression systems for all types of equipment, while others expressed support for automatic fire suppression systems on portable or unattended equipment but were strongly opposed to requiring automatic fire suppression on all types of nonpermissible diesel-powered equipment. These commenters stated that automatic fire suppression systems were much more difficult to maintain, and were unnecessary for equipment that was attended by an equipment operator. These commenters suggested that mine operators should have the option of installing either manual or automatic systems on self-propelled equipment, stating that the equipment operator is in the best position to detect machine fires, and would be able to actuate a manual fire suppression system more easily than an automatic system. Other commenters stated that it might be difficult for an equipment operator to actuate a manual system depending on the size and type of the fire, expressing concern that an equipment operator could be overcome by the effects of a fire or explosion and not be able to manually extinguish the fire.

As discussed more fully under § 75.1911 of the preamble, the Ontario fire accident data indicates that heavy-duty diesel-powered equipment, such as the type specified in § 75.1908(a) of the final rule, presents a much greater fire hazard than light-duty equipment. Although light-duty equipment still presents some fire risk, a manually-actuated fire suppression system provides adequate protection if the equipment is attended and provided with additional safety features for protection of fuel, hydraulic, and electrical systems under this section and § 75.1910 of the final rule. As noted elsewhere in this preamble, § 75.1916(d) of the final rule requires all diesel-powered equipment to be attended while it is being operated.

An automatic fire suppression system is needed on equipment that presents a greater fire risk. Good fire fighting practice demands that a fire be suppressed as early as possible, and several reports of fire indicate that the rapid growth of a fire prevented the equipment operator from actuating the manual fire suppression system. Automatic systems respond quickly to fire without operator intervention, and are needed on equipment that operates frequently for long periods of time under high load, presenting an increased fire risk. Compressors and other non-self-propelled equipment also operate for long periods of time under high load. This results not only in high engine temperatures but also increases the possibility of mechanical failure, presenting ignition and fuel sources. To address these hazards, automatic fire suppression systems meeting the requirements of § 75.1911 of the final rule are required under paragraph (h) for self-propelled heavy-duty nonpermissible equipment, and under paragraph (j)(3) for both heavy-duty and light-duty equipment that is not self-propelled. Paragraph (i) provides that self-propelled light-duty nonpermissible equipment may be provided with either a manual or an automatic system that meets the requirements of § 75.1911.

Paragraph (j) requires nonpermissible diesel-powered equipment that is not self-propelled to be provided with features in addition to those listed in paragraph (a). These features include a means to prevent inadvertent movement of the equipment when parked, safety chains or other suitable secondary connections on equipment that is being towed, and, as discussed above, an automatic fire suppression system meeting the requirements of § 75.1911. A requirement for automatic fire suppression for non-self-propelled equipment has been retained in the final rule in recognition of the fact that non-self-propelled equipment is typically operated under load for extended periods of time, resulting in the need for automatic rather than manual fire suppression to address the additional fire risks. MSHA intends that automatic fire suppression systems be provided for those machines, such as compressors, welders, and generators, that may have some limited capacity for self-propulsion but which essentially function as portable equipment, i.e., where the equipment operator performs a function some distance from the machine while the equipment is running.

The proposal would have required a means to prevent inadvertent movement as well as safety chains or other connections for equipment being towed, but would have required a fire extinguisher instead of an automatic fire suppression system. The proposal would also have required the equipment to be provided with a sensor to monitor equipment operation that would stop the engine when an equipment malfunction would result in the creation of a hazard.

The proposed requirement for sensors to monitor the operation of portable equipment has not been adopted in the final rule. Several commenters expressed confusion as to what these devices were intended to monitor, and suggested that this requirement be eliminated because it was vague and ambiguous. The proposed requirement was intended to ensure that general safety devices supplied as original equipment features, such as low oil sensors or high temperature sensors, were maintained in proper working condition. However, MSHA has concluded that it would be extremely difficult to develop a standard that is any more specific than what was proposed that would be suitable for the variety of monitors and sensors that may be installed on equipment. In light of these circumstances, and in light of the fact that all equipment used in underground coal mines is required to be maintained in safe operating condition under existing § 75.1725, this requirement has not been adopted in the final rule.

A number of commenters recommended that additional equipment safety features be required in the final rule that were not included in the proposal. Several commenters expressed concern about limited visibility from the operator's compartment on certain types of large diesel-powered equipment. The final rule does not adopt these commenters' recommendations. Although this concern is addressed to some extent by § 75.1916 of the final rule, which requires that mines using diesel-powered equipment establish and follow standardized traffic rules, MSHA has concluded that the issue of operator equipment design and visibility should be addressed in the context of all types of equipment, not only diesel-powered equipment. Specific provisions on operator visibility have therefore not been included in the final rule.

Section 75.1910 Nonpermissible Diesel-Powered Equipment; Electrical System Design and Performance Requirements

This section addresses electrical system requirements for nonpermissible diesel-powered equipment. These requirements were proposed in § 75.1909 with other equipment safety requirements that would have applied to a limited class of nonpermissible light-duty equipment, but in the final rule are included separately in § 75.1910.

Faulty equipment electrical systems have frequently been the cause of equipment fires, and the requirements of this section address the hazards associated with these systems. Although commenters generally supported the proposed requirements, one commenter suggested that these requirements not be adopted in the final rule, because some equipment is designed for highway use and meets safety standards that have been developed by the industry over many years. The commenter asserted that changing the design of those machines' electrical systems would have an adverse impact on machine safety. MSHA is aware that electrical systems on certain types of diesel-powered equipment, such as utility vehicles, personnel carriers, and ambulances, are designed to meet safety standards for highway use. However, this final rule expands the scope of the limited class of equipment to include types of equipment that would not meet the requirements for highway use. Additionally, because of the significant hazards presented by a fire in an underground mine, additional safeguards for electrical systems on equipment employing storage batteries and integral charging systems are warranted, given the fact that a number of electrical accidents have been attributed to faults in these systems. The analysis of the Ontario fire accident data revealed that 43 percent of the fires were attributable to electrical system faults. Almost half of these were related to the engine starting and charging systems. Changes in machine design to comply with the requirements in this section are necessary to enhance safety. For these reasons, the final rule retains these special provisions.

The requirements included under this section of the final rule apply only to those electrical circuits and components associated with, or connected to, electrical systems utilizing storage batteries and integral charging systems. It should be noted, as indicated in the rule itself, that these requirements do not apply to equipment that falls within the special category of emergency equipment under § 75.1908(d) of the final rule. The requirements in this section would apply, for example, to circuits for instrument panel gages and machine lights on most equipment utilizing storage batteries and integral charging systems. Accordingly, electrical systems on nonpermissible diesel-powered equipment without storage batteries and charging systems are not governed by the requirements of this section. Additionally, the requirements of this section do not apply to electrical circuits and components on equipment that is not directly connected to or otherwise powered from a separate electrical system utilizing storage batteries and an integral charging system. Both types of systems should be designed and maintained in compliance with existing safety standards in part 75 for underground coal mines.

Several commenters suggested that the proposed electrical system requirements not be adopted in the final rule, and instead that the final rule provide that electrical systems on diesel-powered equipment comply with existing part 75 electrical safety standards for nonpermissible equipment. Some of these commenters also suggested that more performance-oriented standards be developed for electrical circuits and components associated with storage batteries and charging systems.

Performance-oriented requirements have been adopted where appropriate in the final rule to allow flexibility in design and to facilitate future development of new and improved technology. Instead of simply applying existing requirements to this equipment, as suggested by some commenters, many of the requirements of this section have been derived from existing MSHA electrical safety standards in part 75 but have been tailored to apply to diesel-powered equipment.

It should be noted that MSHA does not consider the continuous on-board recharging of the battery on this equipment, which typically power auxiliary features such as headlights, to be the type of battery-charging contemplated by existing § 75.340.

Paragraph (a) addresses overload and short circuit protection of electric circuits and components and, like the proposal, requires that such protection be provided in accordance with existing §§ 75.518 and 75.518–1. The references to the existing sections have been retained in the final rule in response to commenters' suggestions that such references would minimize confusion over what the standard requires.

Paragraphs (b) and (c) are adopted from the proposal and were developed from existing approval requirements for electrical systems on other types of diesel-powered equipment. Paragraph (b) requires that each electric conductor from the battery to the starting motor be provided with short circuit protection, and requires that the short circuit protective device be placed as near as practicable to the battery terminals. Paragraph (c) requires that each branch circuit conductor connected to the main circuit between the battery and the charging generator be provided with circuit protection. When complied with, these requirements will provide all electric conductors and circuits with circuit protection and will minimize the hazards of fire due to circuit failure.

Paragraph (d), like the proposal, requires that a main circuit-interrupting device be provided in the electrical system so that power may be disconnected from the equipment, at or near the battery terminals, in the event of an emergency. The device must be located as close as practicable to the battery terminals and be designed to operate within its electrical rating without damage. This paragraph also requires that the device not automatically reset after being actuated, and that magnetic devices be mounted in such a manner to preclude closing by gravity. This requirement reduces the possibility of a fire in the event of a short circuit protective device malfunction. The proposal would have provided that a manually operated controller, such as a rheostat, would not be acceptable as a service switch. This provision has not been included in the final rule because it is redundant and adds nothing of substance to the paragraph. Manually operated controllers are not typically used on diesel-powered equipment, and would be prohibited in any case by the language in the final rule.

Under the final rule circuit-interrupting devices must be designed not to automatically reset after being actuated. If the circuit has been interrupted it is most likely due to some fault in the system, and an automatic reset would defeat the purpose behind the device. These devices must also be operational within their electrical rating without damage, because otherwise they could self-destruct. Magnetic circuit-interrupting devices are required to be mounted in a manner that prevents gravity from closing the contacts to prevent a premature or undesirable activation of electric circuits. The requirements of this paragraph ensure proper design and installation of circuit-interrupting devices.

The proposed rule would have included the additional requirement that circuit-interrupting devices and other controls be designed so that they could be operated without opening any compartment in which they were enclosed. This proposed provision has not been adopted in the final rule, in response to commenters who advocated performance-oriented requirements. The proposal would also have required that circuit-interrupting devices meet the requirements of existing § 75.520, which simply requires that all electric equipment be provided with switches or other controls that are safely designed, constructed, and installed. This reference adds little or nothing of substance to the requirements of this paragraph, and has not been adopted in the final rule.

Paragraph (e) adopts the proposed requirement that each motor and charging generator be protected from overload by an automatic overcurrent device. This requirement is necessary to ensure proper deenergization of circuits and equipment in the event of overcurrent conditions such as arcing and motor overheating, and, when complied with, will minimize resulting fire hazards. The final rule also adopts the proposed provision that one device will be acceptable when two motors of the same rating operate simultaneously and perform virtually the same duty.

The requirements of paragraph (f), like the proposal, address conductor size and capacity. Proper selection of circuit conductors of adequate size and current carrying capacity and with insulation compatible with the circuit voltage depends on the environmental conditions under which the conductors will be used. Conductor size and capacity are also important in minimizing overload and short circuit conditions which could cause a fire. The final rule adopts the proposed requirements that each ungrounded conductor have insulation compatible with the impressed voltage, and that insulation materials be resistant to deterioration from engine heat and oil. The final rule, like the proposal, also requires that electric conductors meet the requirements of existing §§ 75.513 and 75.513–1, except for electrical conductors for starting motors, which must only comply with the performance-oriented requirements of § 75.513. Existing § 75.513 provides that all electric conductors shall be sufficient in size and have adequate current carrying capacity and be of such construction that a rise in temperature resulting from normal operation will not damage the insulating material. Existing § 75.513–1 provides that an electric conductor is not of sufficient size to have adequate current carrying capacity if it is smaller than provided for in the National Electric Code of 1968.

Existing §§ 75.513 and 75.513–1 were developed for electrical equipment used in outby locations, but they are also suitable for application to all nonpermissible diesel- powered equipment. Greater flexibility is provided for electric conductors for starting motors, which are not required to meet the size and carrying capacity requirements under § 75.513–1, but must only comply with the performance requirements of § 75.513. This is because the conductor size requirements in the 1968 National Electric Code are determined based on the motor running at maximum load, with no allowance for the type of duty. The conductor sizes specified in the Code would therefore not be appropriate for starting motors, which typically run for only a very short period of time.

Several commenters objected to the requirement in the proposed rule that conductors for equipment or accessories added to a vehicle's electrical system after manufacture not be smaller than No. 14 AWG in size, stating that some components were not readily available with wire sizes compatible with this requirement. In response to this comment and in light of the requirements that have been adopted in the final rule, which will provide adequate protection, the proposed size restriction on certain conductors is not adopted in the final rule.

Since damaged or defective conductors or components may present potential fire hazards, paragraphs (g) and (h) address the protection of electric circuits and components. Paragraph (g), like the proposal, requires all wiring to have adequate mechanical protection to prevent damage to the cable that might result in short circuits. Paragraph (h) adopts the proposed requirement that sharp edges and corners be removed at all points where there is a possibility for damaging wires, cables, or conduits by cutting or abrasion. The insulation of the cables within a battery box is also required to be protected against abrasion. These paragraphs ensure that circuits are physically protected and secured from movement or displacement caused by vibration, as well as from cutting or abrasion. The proposed rule would have included the additional requirements that wiring have adequate electrical protection to prevent cable damage, and that wiring be installed in accordance with existing § 75.515, as applicable. The reference to electrical protection in the proposal was determined to be redundant, and has not been adopted in the final rule. The reference to existing § 75.515 in the proposal has also not been adopted in the final rule, because it simply restates requirements already included in the final rule.

Paragraph (i) requires electrical connections and splices to be electrically and mechanically efficient, in addition to having adequate insulating properties. Insulating material would be required in applications where space is limited and where the possibility exists of arcs striking metal walls or parts. These precautions minimize fire hazards from improper or loose connections and splices as well as insufficient electrical clearances, which could cause a fire due to conductor overheating or electrical arcing. In response to comments, specific references to bolted connectors and to existing § 75.514 have been deleted and replaced with more performance-oriented requirements.

Paragraph (j) of the final rule, like the proposal, requires storage batteries to be secured in place to prevent undue movement and protected from external damage. Batteries not protected from damage by their location on the equipment are required to be housed in a battery box.

Paragraphs (k) through (o) of the final rule set forth requirements for battery box construction, and are adopted from the proposal with slight revision. These requirements provide for a substantially constructed battery enclosure and address battery insulation, ventilation, and chemical reaction from electrolyte. A number of commenters suggested that more performance-oriented requirements be adopted for battery box construction. However, the proposed design specifications have been retained in the final rule because they set forth the minimum construction requirements needed to protect a battery from external damage. One commenter related an incident where a battery case had deteriorated, resulting in arcing and sparking between the battery terminal and the frame of the machine. Other reports of fires from the Ontario fire accident data indicate that a number of fires had been caused by batteries that were not secured in place or adequately protected from external damage. The minimum design and construction requirements for battery boxes in the final rule are necessary to reduce these types of hazards.

Paragraph (k) provides that the battery box, including the cover, must be constructed of steel with a minimum thickness of ⅛ inch, or of a material other than steel that provides equivalent strength. One commenter specifically

cited the proposed 3/16-inch thickness requirement as an example of an unnecessary design requirement. This requirement has been changed to 1/8-inch minimum thickness to conform to existing part 7 requirements for battery boxes containing batteries no greater than 1,000 pounds. Thinner battery box cross sections would not provide adequate protection for the battery and could result in a fire or explosion.

Paragraph (l) provides that battery-box covers must be lined with a flame-resistant insulating material permanently attached to the underside of the cover, unless equivalent protection is provided. Battery-box covers must also be provided with a means for securing them in a closed position. At least ½-inch of air space must be provided between the underside of the cover and the top of the battery, including terminals. Paragraph (m) requires battery boxes to be provided with ventilation openings to prevent the accumulation of flammable or toxic gases or vapors within the battery box. The size and locations of openings for ventilation must prevent direct access to battery terminals. Paragraph (n) requires the battery to be insulated from the battery-box walls and supported on insulating materials. Insulating materials that may be subject to chemical reaction with electrolyte must be treated to resist such action. Finally, paragraph (o) requires drainage holes in the bottom of each battery box.

*Stationary unattended diesel-powered equipment.* The Diesel Advisory Committee recommended that stationary unattended diesel-powered equipment be prohibited where permissible electric equipment is required, and that stationary unattended equipment used elsewhere in the mine be provided with the fire prevention features required for electrical installations and mobile diesel-powered equipment. The Committee recommended that stationary unattended equipment be equipped with specific machine features, such as surface temperature controls, an automatically and manually actuated fire suppression system, an engine shutdown device, and a means to shut down the engine from the surface. The Committee also recommended that stationary unattended equipment be housed in a fireproof enclosure ventilated to a return air course.

Section 75.1910 of the proposed rule incorporated the recommendations of the Advisory Committee for stationary unattended equipment. Specifically, proposed § 75.1910 would have prohibited stationary unattended diesel-powered equipment in areas of the mine where permissible electric equipment was required or in the primary escapeway. Stationary unattended equipment located in other areas of the mine would have been required to have a diesel power package approved under subpart F or G of part 7. Additional safety features were proposed for this equipment, including fuel system requirements, limitations on storage of the equipment fuel supply, and a methane monitor that would shut down the engine in the presence of 1.0 percent concentration of methane.

A number of commenters were concerned that the proposed rule dealt with stationary unattended diesel-powered equipment differently than existing standards addressed unattended electrical equipment, and imposed unnecessary restrictions. These commenters stated that it was excessive to require approved power packages on equipment when the equipment is already housed in a noncombustible enclosure, vented to a return air course, protected by an automatic fire suppression system, and equipped with a device that shuts down the equipment and sounds an alarm at an attended surface location. Several commenters stated that unattended electric equipment, which they believed presented similar ignition sources, was not required to have methane monitors, and that such monitors were not necessary, given the outby locations where stationary nonpermissible equipment would operate.

Other commenters favored a complete prohibition of unattended diesel equipment in underground coal mines, stating that diesel equipment presented too great a fire hazard to allow it to be operated unattended, even with the imposition of rigid safety requirements. One commenter referred to the 1984 Wilberg Mine disaster, where a fire started by an unattended electrical compressor killed 27 miners. In the alternative, these commenters recommended that extensive additional requirements be imposed on stationary unattended equipment, including a requirement that the equipment be permissible, and that the enclosure housing the equipment meet a 2-hour fire resistance test.

One commenter stated that there should be clarification of what constitutes ''stationary'' versus ''portable'' equipment. The commenter pointed out that some types of equipment, such as compressors, are portable because they are capable of being transported by rail or otherwise carried, but that the equipment can also be placed in a remote location and operated there for an indefinite period of time.

In considering these comments, MSHA reviewed data to determine the types of equipment that would be affected by the proposed requirements for stationary unattended equipment. This review revealed that there were approximately 200 pieces of equipment that were currently being operated either as stationary unattended equipment or as portable attended equipment. Equipment such as air compressors, generators, mine sealant machines, hydraulic power units, rock dusters, water spray units, and welders fell into this category. Water spray units are used to wash mining equipment; mine sealant machines apply sealants to stoppings or mine surfaces; hydraulic power units are used to operate certain special purpose tools; rock dusters are used to apply rock dust to mine surfaces; and diesel-powered welders are used where electric power is not readily available. An operator must be present to perform the main function of all of these types of equipment, i.e., welding, rock dusting, etc.

MSHA's review also revealed that diesel-powered generators are typically used to provide electrical power to move equipment with electric motors from place to place in the mine. An equipment operator is also in attendance when this type of equipment is being used. Finally, MSHA's review also indicated that diesel-powered compressors are used in a manner similar to hydraulic power units, with an operator in attendance, to provide a source of compressed air to operate tools such as pneumatic hammers and drills.

From this review, MSHA has concluded that diesel-powered equipment is not commonly operated unattended in a permanent location, but instead is operated with a person in close proximity. The final rule includes a definition of what constitutes attended diesel-powered equipment in § 75.1908, which provides that the equipment must either be operated by a miner, or located within 500 feet of a job site where a miner is located. Essentially all of the diesel-powered equipment currently operated in underground coal mines is ''attended'' under the final rule's definition. In light of this determination, and also in light of the serious concerns expressed by some commenters about the possible fire hazards presented by unattended diesel-powered equipment operating underground, § 75.1916(d) of the final rule prohibits the operation of unattended diesel-powered equipment in underground coal mines.

Consequently, the proposed requirements addressing the operation of stationary unattended diesel-powered equipment are not adopted in the final rule.

As a result of the final rule's prohibition against operation of unattended diesel-powered equipment in underground coal mines, conforming amendments are necessary to several existing standards, primarily to delete unnecessary references to unattended diesel-powered equipment. Existing § 75.360 lists the locations where preshift examiners must examine for hazardous conditions, test for methane and oxygen deficiency, and determine if the air is moving in the proper direction. The final rule deletes from these locations the reference in § 75.360(b)(7) to ''where unattended diesel equipment is to operate.'' Additionally, existing § 75.380(f)(3)(i) included a prohibition against operation in the primary escapeway of unattended diesel equipment without an automatic fire suppression system. This reference is deleted by the final rule.

Finally, existing § 75.344 deals with the use of air compressors underground, including unattended diesel compressors. The final ventilation rule that was published in October 1989 made clear that the application of the requirements of § 75.344 to diesel compressors would be removed when the final rule for diesel equipment was promulgated. [54 FR 40950]. The reference to diesel compressors in paragraph (d) of § 75.344 is therefore removed by the final rule.

Section 75.1911—Fire Suppression Systems For Diesel-Powered Equipment And Fuel Transportation Units

Section 75.1911 of the final rule establishes requirements for the design, installation, and maintenance of fire suppression systems used on diesel-powered equipment and fuel transportation units in underground coal mines. Under the final rule, both permissible and nonpermissible diesel-powered equipment is required to be equipped with fire suppression systems. The requirement for installation of fire suppression systems on permissible diesel-powered equipment is contained in the final rule at § 75.1907(b)(2),and for nonpermissible equipment at § 75.1909 (h), (i), and (j)(3). Nonpermissible diesel-powered equipment typically includes scoops, personnel carriers, and pickup trucks.

The Diesel Advisory Committee recommended that fire suppression systems be required on certain types of diesel-powered equipment, in addition to surface temperature controls, to address fire hazards created by other machine system malfunctions such as brake components overheating, severing of a fuel line or hydraulic line, and electric component short-circuiting. The Committee made a number of recommendations regarding the application of fire suppression systems to specific types of equipment such as nonpermissible equipment, limited class equipment, and stationary equipment. The proposed rule included design, installation and maintenance requirements for fire suppression systems on diesel-powered equipment and fuel transportation units. These requirements would have been applicable to approved equipment, limited class equipment, and fuel transportation units, both self-propelled and towed.

Commenters to the proposed rule generally accepted the need for fire suppression systems on diesel-powered equipment operated in underground coal mines. However, comments varied on what the requirements for fire suppression systems should be. Some commenters recommended that only manufacturer's requirements for design, installation and maintenance be used. Other commenters suggested a more detailed approach and recommended that the final rule outline specific requirements for fire suppression systems.

Fire suppression systems are necessary on diesel-powered equipment, including fuel transportation units, because of the numerous fuel sources, including diesel fuel, hydraulic fluid, and combustible material, and several potential ignition sources, such as hot exhaust components, dragging brakes, and electrical wiring on this type of equipment. Accident reports describe machine fires caused by hot exhaust components, dragging brakes and shorted electrical components igniting diesel fuel, hydraulic fluid, brake fluid, lube oil, and other combustible materials, such as electrical insulating material.

Fire suppression systems are designed to extinguish fires quickly, in their incipient stage, and to reach all locations where a fire may occur. This is important for diesel-powered equipment because a fire must be extinguished quickly before fuel sources can further propagate a fire. For example, if a fire is not extinguished at an early stage, leaking diesel fuel or hydraulic fluid can fuel a fire and result in an increase in the intensity and size of the fire. Also, promptly extinguishing a fire prevents reignition through the contact of hot surfaces created by the fire with leaked or spilled diesel fuel or hydraulic fluid. Fixed fire suppression systems also offer two advantages over portable fire extinguishers: fast attack and application of the suppressant to difficult-to-reach areas on and under diesel machines where fires may occur.

An automatic fire suppression system uses a supplemental detection device to sense an early warning of a fire. The fire detection system, which is generally actuated by either smoke or heat, automatically sends a signal to the system for the discharge of suppressant agent. Manual fire suppression systems require a person to actuate the fire suppression system by either pushing a button or throwing a switch to discharge the fire suppressant agent to the hazard. Both automatic and manual fire suppression systems utilize a network of piping and nozzles to allow suppressant agent to be released and distributed directly at a predetermined fire hazard.

Under the final rule, fire suppression systems are required to provide fire suppression and, if an automatic system is installed, fire detection for the engine, transmission, hydraulic pumps and tanks, fuel tanks, exposed brake units, air compressors, battery areas and other areas as necessary. The final rule also requires that automatic fire suppression systems include audible and visual alarms to warn of fires or system faults and automatic engine shutdown in the event of a fire. In addition, the final rule requires all fire suppression systems to be tested and maintained in accordance with manufacturer's recommendations. Finally, the rule establishes certain recordkeeping requirements for faulty fire suppression systems that are found during inspection and testing.

Paragraph (a) of this section of the final rule provides that the fire suppression system required by §§ 75.1907 and 75.1909 must be a multipurpose dry chemical type (ABC) fire suppression system listed or approved by a nationally recognized independent testing laboratory and appropriate for installation on diesel-powered equipment and fuel transportation units.

The proposed rule would have required an automatic multipurpose dry powder type fire suppression system suitable for its intended application and listed or approved by a nationally recognized independent testing laboratory on diesel-powered equipment and portable diesel-powered equipment and fuel transportation units. The proposal would have further established fire suppression requirements for approved equipment, limited class equipment, and fuel transportation units, both self-propelled and towed.

Commenters expressed support for automatic fire suppression systems on portable or unattended diesel-powered equipment. A number of commenters, however, stated that automatic fire suppression systems are not needed on self-propelled diesel-powered equipment, because this type of equipment is attended by an equipment operator. These commenters suggested that mine operators should have the option of providing either manual or automatic fire suppression systems on self-propelled diesel-powered equipment, stating that the equipment operator is in the best position to detect incipient fires on the machine and is able to actuate a manual fire suppression system more easily than an automatic system. Some commenters stated that automatic fire suppression systems are not necessary on mobile diesel-powered equipment because this type of equipment will already be required to have fire protection and shutdown features. Commenters also stated that automatic systems can require extra maintenance and are susceptible to vibration, which can cause them to discharge unexpectedly. In addition, commenters stated that automatic fire suppression systems should not be required on vehicles with surface temperature controls, such as permissible vehicles, because compatible permissible systems were not available at the time of the proposal.

Other commenters supported the proposal for automatic fire suppression systems on all types of diesel-powered equipment. In testimony before the Diesel Advisory Committee, equipment manufacturers and mine operators endorsed the use of automatic fire suppression systems on several types of diesel-powered equipment and gave examples of current applications. Other commenters to the proposal observed that it might be difficult for an equipment operator to actuate a manual system depending on the type and size of a fire. These commenters expressed concern that an equipment operator could be overcome by the effects of a fire or explosion and not be able to manually extinguish the fire. Some commenters also expressed concern that a manually-actuated system would be ineffective for a fire that started after the equipment had been shut off and the equipment operator had left the area.

Paragraph (a) of this section of the final rule does not adopt the proposed requirement for installation of an automatic fire suppression system on all mobile diesel-powered equipment. Instead, the final rule establishes requirements for both manual and automatic fire suppression systems. The type of fire suppression system required for installation on diesel-powered equipment is specified in § 75.1907(b)(2) for permissible equipment, and § 75.1909 (h), (i), and (j)(3) for nonpermissible equipment.

The Ontario fire accident data indicated that heavy-duty diesel-powered equipment of the type defined in the final rule at § 75.1908(a) presents a much greater fire hazard than light-duty equipment defined under the final rule at § 75.1908(b). The data showed that heavy-duty diesel-powered equipment, which includes equipment that cuts or moves rock or coal, equipment that performs drilling or bolting functions, and fuel transportation units, had 247 fires (85 percent) of the total number of fires. Heavy-duty equipment frequently works under load and can develop large areas of hot engine surfaces. This equipment is prone to mechanical breakdown, especially hydraulic hose and electrical cable failure, creating a serious risk that the equipment will develop both an ignition source and provide a source of fuel for a fire.

By contrast, light-duty diesel-powered equipment, which under the final rule includes supply vehicles, maintenance vehicles, personnel carriers, and other equipment not used to move rock or coal, accounted for 43 (15 percent) of the total number of fires. Light-duty equipment is not used in the actual mining process and is generally not worked very hard and typically used only intermittently during a shift. While over a third of the fires on heavy-duty equipment were started by hot engine surfaces, fewer than 10 percent of the fires on light-duty equipment were started by hot engine surfaces. Fires related to the electrical system accounted for 60 percent of the light-duty equipment fires. Electrical fires tend to smolder and provide more time for action to be taken to extinguish the fires than do diesel fires.

Although light-duty equipment still poses a fire risk, this risk can be adequately addressed by fire suppression systems which take into account the manner in which light-duty equipment is used and the types of fires that typically occur on it. The final rule, therefore, does not adopt the proposal that automatic fire suppression systems be installed on all diesel machines.

A manually-actuated fire suppression system provides adequate protection on light-duty self-propelled equipment. This type of equipment is attended by its operator at all times that it is operating as required by § 75.1916(d) of the final rule. As discussed by several commenters to the proposal, it has been their experience that a well-maintained manually-actuated fire suppression system is appropriate if the equipment is attended. These commenters stated that manually-actuated fire suppression systems are adequate in conjunction with additional protective features for fuel, hydraulic, and electrical systems, to provide fire protection on outby diesel-powered equipment. In addition to a manual fire suppression system, protective features for fuel, hydraulic, and electrical systems are required on both heavy-duty and light-duty nonpermissible equipment under §§ 75.1909 and 75.1910 of the final rule.

Automatic fire suppression systems are necessary on equipment that poses a higher fire risk. This includes heavy-duty equipment, which presents an increased fire hazard as discussed above. It also includes equipment for which the operator is not immediately present at the controls of the machine at all times it is operated, such as compressors. Good fire fighting practice requires that the fire be attacked as early as possible. Further, several reports indicate that the rapid growth of fire prevented the equipment operator from actuating the manual fire suppression system. Automatic systems provide a fast response without operator intervention. Compressors and other non-self-propelled equipment frequently operate for long periods of time under high load. This results in sustained high engine surface temperatures, which can provide an ignition source for a fire and increase the likelihood of a a mechanical failure providing a fuel source for a fire. Also, the individual operating the compressor may be some distance from the machine, and would not be able to promptly actuate the fire suppression system. To address these hazards, the final rule adopts the proposed requirement for automatic fire suppression systems for heavy-duty and non-self-propelled equipment.

One commenter to the proposal stated that the requirement in paragraph (a) that the ''system be suitable for the intended application'' was ambiguous and could be subject to different interpretations. This commenter stated that the term ''suitable'' could refer to a system that is suitable for a particular type of fire (class B flammable or combustible liquid fire) or it could mean that the system has a sufficient capacity to extinguish a fire on a particular piece of equipment. Other commenters recommended that the final rule specify the capacity of the fire suppression system.

The final rule responds to commenters' concerns by requiring that

fire suppression systems be multipurpose dry chemical type (ABC) fire suppression systems listed or approved by a nationally recognized independent testing laboratory, and appropriate for installation on diesel-powered equipment. The final rule does not adopt the language ''suitable for the intended application.''

The capacity and suitability of fire suppression systems for protecting against specific fire hazards are specified as part of the listing or approval by the nationally recognized independent testing laboratory. The nationally recognized independent testing laboratory system listing or approval does not necessarily designate the system for a specific type of equipment, such as fuel transportation units or even diesel-powered equipment. Instead, the listing or approval uses a more general description such as mobile mining equipment or vehicle protection. Listing or approval by a nationally recognized independent testing laboratory ensures that a fire suppression system is properly designed for a particular type of fire protection hazard by putting the system through a series of specific performance tests. The system must also meet rigid design requirements in order to gain approval or listing.

Fire suppression systems should be installed by a qualified individual following the installation and maintenance instructions in the system manufacturer's installation manual. The sizing of a fire suppression system is dependent on the number of nozzles needed to adequately cover all of the fire hazard areas that have been identified. The number of dry chemical canisters required will be proportional to the number of hazard areas that must be covered by the nozzles. This information can be obtained from the installation manual that is part of the listing or approval documentation. Other installation considerations, such as proper location and guarding of nozzles and other system components to prevent damage, are addressed in the system's installation manual. In addition to the installation requirements in the manual, follow-up maintenance and inspection procedures are provided.

Also modified in this section from the proposal is the term ''chemical'' replacing the term ''powder'' and the addition of the letter references ''ABC'' for the three classes of fire. These modifications are made in response to commenters' requests for clarification and to incorporate more appropriate terminology.

A multipurpose dry chemical type system is capable of suppressing the three classes (ABC) of fires on diesel-powered equipment. A class A fire refers to fires of combustible solid materials such as paper, rubber, textiles, and cloth, and would typically involve such items as tires, hosing or seats on diesel-powered equipment. A class B fire on diesel-powered equipment would involve diesel fuel. Class C fires involve electrical components, and could include such components as lights, pumps, and components of the control panel on diesel-powered equipment. A multipurpose dry chemical type agent is specifically designed to extinguish ABC class fires.

Paragraph (a)(1) of the final rule, like the proposal, requires that the fire suppression system be installed in accordance with the manufacturer's specifications and the limitations of the nationally recognized independent testing laboratory listing or approval. Commenters generally expressed support for this aspect of the proposal. This requirement ensures that the system is installed within the limits defined by the listing or approval organization and as specified by the fire suppression system manufacturer. Since the system already is performance-tested to a specific standard and in certain configurations, it must be installed within these parameters to be effective.

Paragraph (a)(2) adopts the requirement from the proposal that the fire suppression system be installed in a protected location or guarded to minimize physical damage from routine vehicle operations. No specific comments were received on this aspect of the proposal. In order for fire suppression systems to work properly, they must not be subjected to damage from the mining environment. Damage to any part of the fire suppression system can result in a malfunction of the entire system and in the system not responding to a fire. For example, a rock fall can pinch a hose or crush a sensor and create faults that can disable either the entire system or a portion of the system that covers a certain area of the machine.

Paragraph (a)(3), like the proposal, requires that the suppressant agent distribution tubing or piping be secured and protected against damage, including pinching, crimping, stretching, abrasion, and corrosion, and that the discharge nozzles be positioned and aimed for maximum fire suppression effectiveness in the protected areas. No specific comments were received on this aspect of the proposal. During the normal operation of diesel-powered equipment in the confined space of a coal mine, a fire suppression system can become damaged from collision or nozzles positioned at a specific predetermined location can be redirected away from a fire hazard.

Paragraph (a)(4), like the proposal, requires that fire suppression nozzles also be protected against the entrance of foreign materials. No specific comments were received on this aspect of the proposal. The openings in the nozzles used on multipurpose dry chemical fire suppression systems can be as small as ⅛ of an inch. If material such as mud, coal dust, or rock dust enters the nozzle, it can prevent the chemical agent from discharging entirely, or alter the pattern and coverage of fire suppressant.

Paragraph (b) of the final rule requires fire suppression and, if the system is automatic, fire detection for certain coverage areas on diesel-powered equipment. Under the final rule, the coverage areas include the engine (including the starter), transmission, hydraulic pumps and tanks, fuel tanks, exposed brake units, air compressors and battery areas on diesel-powered equipment and electric panels or controls used on fuel transportation units. This requirement ensures that fire detection and fire suppression are provided with coverage for key areas of diesel-powered equipment and fuel transportation units.

Although the listing or approval generally describes areas on equipment that pose a fire hazard, it does not specifically identify which hazards must be covered by fire suppression. The final rule's requirement for specific fire suppression coverage for certain areas on diesel-powered equipment is supported by the Ontario fire data. The data showed that engine fires accounted for 99 (34 percent) of the total number of fires on diesel-powered equipment. Included in engine fires were 10 compressor fires, 27 hydraulic system fires, 11 transmission fires, and 7 fuel tank fires. The Ontario fire data also indicate 32 battery fires and 55 brake fires.

The scope of paragraph (b) is expanded to include the starting mechanism on diesel-powered equipment. This responds to commenters' recommendations that foreign fire data be evaluated to establish criteria for fire protection on diesel-powered equipment. The Ontario fire accident data indicate that starters, starter solenoids, and the wiring associated with these components present a fire hazard. The data showed 21 (17 percent) of the electrical fires on self-propelled diesel-powered equipment were caused by starter circuits. Also, the proposal included the engine compartment as an area to be

covered by the fire suppression system. The specific reference to the starter area in the final rule clarifies that the starter area of the engine compartment be covered by the fire suppression system.

The proposed rule specified fire suppression system coverage areas for various types of limited class equipment. Because of the different fire hazards presented by the various types of equipment listed in the proposal, separate provisions in proposed paragraph (b)(1) were included. In the final rule the limited class category of light-duty equipment is expanded to include a range of equipment types, beyond the types defined in the proposal, and the requirements for coverage areas have been combined.

Proposed paragraph (b)(2) has not been adopted in the final rule to the extent that it would have specified coverage areas around fuel transportation units in response to commenters' statements that fuel tanks by themselves do not constitute a fire hazard, and only need coverage if an associated ignition source is present. Proposed paragraph (b)(3), which would have required fire suppression coverage for fuel containers and electric panels or controls used during fuel transfer operations on fuel transportation units, has not been adopted because the term ''container'' is no longer used in the final rule. The phrase ''during fuel transfer operations'' was not adopted from the proposal to eliminate the inference that only electric panels or controls used during fuel transfer operations must have coverage. Under the final rule, electrical components installed on fuel transportation units must be covered by fire suppression systems. However, a vehicle's instrument panel located in the operator's compartment of the machine would not be considered ''electrical panels and controls.'' Expelling fire suppressant in the operator's compartment would create other hazards for the equipment operator such as a cloud of fire suppressant which could limit visibility.

Paragraph (c), like the proposal, requires that automatic fire suppression systems include audible and visual alarms to warn of fires or system faults. No specific comments were received on this aspect of the proposed rule. This requirement provides a means for immediate notification of the equipment operator, both audibly and visually, when the system detects a fire on the machine or a problem with the fire detection device. The audible and visual indication of fire detection can alert the equipment operator of the imminent discharge of the chemical agent and the engine shutdown required by paragraph (d).

Paragraph (d) of the final rule adopts the proposed requirement that the fire suppression system provide for automatic engine shutdown. The final rule also provides that if the fire suppression system is automatic, engine shutdown and discharge of suppressant agent may be delayed for a maximum of 15 seconds after the fire is detected by the system. Commenters expressed support for this aspect of the proposed rule.

The engine shutdown requirement is intended to prevent an engine from continuing to run once the system has been actuated, either automatically or manually. This will prevent the engine from pumping diesel fuel or hydraulic fluid through a leaking fuel line or hydraulic hose, fueling the fire that the fire suppression system is attempting to extinguish. Since fire suppression systems are designed to suppress fires in their incipient stages, the contribution of additional fuel to the fire may render the system ineffective. The Ontario accident data included a number of machine fires where the engine continued to feed the fire with diesel fuel or hydraulic fluid, reducing the effectiveness of the system's ability to suppress the fire. In addition, the engine shutdown feature prevents the engine cooling fan from dispersing the fire suppressant agent before it extinguishes the fire. A maximum of 15 seconds delay between the time of fire detection and actuation provides a limited period of time for the equipment operator to stop and exit the machine before the machine engine shuts down.

Paragraph (e) of the final rule adopts the proposed requirement that the fire suppression system be operated by at least two manual actuators. One actuator must be located on each side of the equipment, and if the equipment is provided with an operator's compartment, one actuator must be located in the compartment within easy reach of the equipment operator.

Several commenters expressed the opinion that two manual actuators were unnecessary on small units of diesel equipment, such as tractors, when the second actuator would have to be installed in close proximity to the engine. Another commenter urged that actuators be separated from each other by a means of a check valve or other device to allow the system to operate even if there is an open line in the actuation circuit.

Two actuators for a fire suppression system are important to afford ample opportunity to initiate the system, even on small units of diesel-powered equipment. For example, if only one actuator were located on the side of a piece of equipment, the equipment operator might be unable to access the actuator due to the confined spaces in an underground coal mine, or because the fire ignited in the same location as the actuator. The final rule requirement for two manual actuators is also consistent with existing § 75.1107 for dry chemical fire suppression systems for electric equipment.

The final rule does not include a requirement for a check valve between the actuators for fire suppression systems. This is part of the system design and is more appropriately addressed by the system manufacturer and the listing or approving nationally recognized independent testing laboratory.

Paragraph (f) adopts the proposed requirement that the fire suppression system must remain operative in the event of engine shutdown, equipment electrical system failure, or failure of any other equipment system. No specific comments were received on this aspect of the proposed rule. This requirement is intended to ensure that the functioning of the system is not dependent on any external power source, such as an engine-driven alternator, vehicle battery, or the proper operation of any other machine system.

Paragraph (g), like the proposal, requires that the electrical components of each fire suppression system installed on diesel-powered equipment used where permissible electric equipment is required be permissible or intrinsically safe, and that such components be maintained in permissible or intrinsically safe condition. This provision requires that automatic fire suppression systems be certified or approved by MSHA under part 18.

A number of commenters to the proposal stated that intrinsically safe vehicle-type automatic fire suppression systems were not available. Currently, however, two fire suppression system manufacturers have obtained approval under part 18 for their automatic fire suppression systems.

Paragraph (h) adopts the requirement from the proposal that electrically operated detection and actuation circuits be monitored and provided with status indicators showing power and circuit continuity. If the system is not electrically operated, a means must be provided to indicate the functional readiness status of the detection system. These features notify the equipment operator or maintenance person of the functional readiness status of both the detection and actuation circuit and the power source. No specific comments

were received on this aspect of the proposed rule.

Currently at least one manufacturer is marketing an automatic fire suppression system with these electrical features on both permissible and nonpermissible systems. There is also an automatic system which is not electrically operated and employs a pressurized cylinder to disperse the suppressant. A pressure gauge on the cylinder is considered sufficient to indicate the condition of the system.

Paragraph (i) requires that each fire suppression system be tested and maintained in accordance with the manufacturer's recommended inspection and maintenance program and as required by the nationally recognized independent testing laboratory listing or approval. It also requires fire suppression systems to be visually inspected at least once each week by a person trained to make such inspections.

The proposed rule would have required each fire suppression device to be visually inspected at the same interval by a person qualified to make such inspections. The proposal also would have required that each fire suppression device be tested and maintained in accordance with applicable requirements in § 75.1100.

Commenters to the proposal generally expressed support for required maintenance of fire suppression systems installed on diesel-powered equipment. Some commenters, however, recommended that a maintenance program specifically designed for fire suppression systems be developed at each mine. One commenter stated that a visual inspection of fire suppression systems on diesel-powered equipment would not be adequate and recommended that fire suppression systems be maintained in accordance with the manufacturer's guidelines by either outside entities qualified by the equipment manufacturer or through a program to qualify individuals at the mine. Another commenter to the proposal recommended that the manufacturer's inspection and maintenance program be referenced in lieu of the requirements in § 75.1100. One commenter stated that automatic fire suppression systems are more difficult to maintain than manual systems, but that both types of systems should be inspected monthly and maintained semi-annually as a minimum. Another commenter expressed concern that certain critical internal components of a fire suppression system could be checked simply by a visual inspection.

Under the final rule, the weekly visual inspection is not intended to be an in-depth inspection. The weekly visual inspection is intended to be a quick check to determine if defects, such as disconnected hose lines or altered nozzles, are readily apparent. The in-depth inspection takes place as part of the manufacturer's recommended testing and inspection procedure also required under the final rule. Fire suppression system manufacturers are most familiar with the design and operation of their systems and are best able to identify the components that need maintenance as well as the type and frequency of maintenance. Adequate maintenance is essential because of the importance of these systems in suppressing machine fires. Maintenance and testing requirements for fire suppression systems are included in the final rule in addition to the requirement for a weekly visual inspection.

The manufacturer's inspection and maintenance procedures are typically spelled out in great detail in the manufacturer's manual and, depending on the operating environment, include the recommended inspection intervals. In addition, these inspection and maintenance procedures are evaluated as part of the system's approval or listing by a nationally recognized independent testing laboratory.

The requirement in this paragraph is identical to the requirement in existing § 75.1107–16(a). However, the fire suppression system requirements in §§ 75.1107–3 through 75.1107–16 cannot be directly applied to diesel-powered equipment for several reasons. Any modification of these existing requirements by inserting the term ''diesel-powered'' in the regulatory language would result in an extremely confusing regulation. Also, the fire hazards presented by diesel-powered equipment are different from those on electric-powered equipment, due to the close proximity of large quantities of hydraulic oils and fuels to the heated diesel engine exhaust. The single modification made to this paragraph was replacing the term ''device'' with the term ''system''. This was done because MSHA intends that the whole system be inspected and not just individual components of the system.

Although automatic systems have additional components that must be inspected and maintained, properly trained maintenance personnel should have little difficulty satisfying these requirements. It is anticipated that the training of the personnel assigned to perform the testing and maintenance of fire suppression systems will be provided by the system manufacturer or distributor. Additionally, automatic fire suppression systems under the final rule are required to have a status monitoring feature to tell the equipment operator or maintenance personnel that a problem exists.

Section 75.1915(b)(3)(iv) of the final rule requires that the training and qualification program for qualified persons working on diesel equipment address tests and maintenance of fire suppression systems. The qualified person conducting maintenance on fire suppression systems on diesel-powered equipment should have sufficient familiarity with the elements of the fire suppression system. A person ''trained'' to perform inspections and tests required by paragraph (i) of this section of the final rule is not required to be a person qualified under § 75.1915. However, the final rule intends that the person performing tests and inspections of fire suppression systems have sufficient knowledge to determine whether a fire suppression system is functioning properly. MSHA anticipates that since fire suppression systems are common to both electric and diesel equipment, the mine operator will work with either the fire suppression system manufacturer or distributor to ensure that personnel responsible for the maintenance of fire suppression systems are adequately trained.

Paragraphs (j) of the final rule establishes recordkeeping requirements which address the inspection and maintenance requirements for fire suppression systems set forth in paragraph (i). Paragraph (j) of the final rule requires that persons performing inspections and tests of fire suppression systems record results of tests and inspections only when a fire suppression system does not meet the installation or maintenance requirements of this section. Under these circumstances, the person performing the inspection or test is required to record the equipment on which the fire suppression system did not meet the installation or maintenance requirements of this section, the defect found, and the corrective action taken. The final rule also requires that these records be kept either manually or electronically in a secured manner that is not susceptible to alteration. Paragraph (j)(3) requires that records be maintained at a surface location at the mine for one year and made available for inspection by an authorized representative of the Secretary and miners' representatives.

The proposal would have required that a record be kept of all inspections and tests of fire suppression systems

and maintained at an appropriate location for each fire suppression device. One commenter to the proposal recommended that, in order to provide adequate maintenance of fire suppression systems, interested parties be allowed to view the results of visual inspections recorded in approved books. Another commenter recommended that records of inspections be maintained on the surface by the operator so that they would be available for MSHA verification. This commenter stated that maintaining separate records for inspections of fire suppression systems is an unnecessary burden for the mine operator. This commenter stated that records kept on computers, as pre-shift examinations and by normal maintenance inspections, would be adequate for documenting the inspections conducted on fire suppression systems.

Office of Management and Budget guidance comments directed MSHA to reexamine the recordkeeping requirements in the proposal and recommended that the final rule require paperwork that was the least burdensome necessary. MSHA has done so, and the final rule does not adopt the proposal that all fire suppression system test and maintenance results be recorded. In response to commenters and consistent with other provisions of the final rule, paragraph (j) requires that records of inspections and tests be made only when a fire suppression system does not meet the installation or maintenance requirements of this section. This requirement is important because if a fire suppression system does not meet the installation or maintenance requirements of this section, the defect could be sufficiently serious to cause the system to fail in the event of a fire. This requirement is intended to ensure that records are maintained and made available to interested parties when a defect is found, and that the appropriate level of mine management is made aware of defects requiring corrective action.

The final rule does not specify a particular way of recording the test and maintenance data, only that the records be located at the surface of the mine. The records of the inspections and tests must be made in a secure media not susceptible to alteration. A detailed discussion of the subject of acceptable record books and electronic records can be found under the heading ''Recordkeeping Requirements'' in the General Discussion section of this preamble.

The final rule does not adopt the requirement from the proposed rule that records of inspections be maintained at an appropriate location near each fire suppression system. Instead, paragraph (k) of the final rule establishes the requirement recommended by a commenter that records of inspections and tests be maintained at a surface location at the mine. Storing records on the surface at the mine makes them more accessible to interested parties. Also in response to commenters, the final rule provides access to not only miners' representatives but to authorized representatives of the Secretary. This provision ensures that test and inspections of fire suppression systems are being made and, when a defect is found, that corrective action is taken.

Records for inspection of diesel-powered equipment are also required under § 75.1914(f)(2) of the final rule. However, the recordkeeping requirement under paragraph (j) is not intended to be duplicated. While § 75.1914(f)(2) applies to diesel-powered equipment, some diesel fuel transportation units may be portable trailers with only electrical components and therefore would need to be covered under the recordkeeping requirement under paragraph (j) of this section. The only records required for fire suppression systems under this section of the final rule are for tests and maintenance required under paragraph (i).

Paragraph (k) adopts the proposed requirement that all miners normally assigned in the active workings of the mine be instructed about the hazards inherent to the operation of fire suppression systems, and where appropriate, the safeguards available for each system. This requirement is intended to ensure that all miners working in areas where fire suppression systems operate are instructed in any inherent hazards and necessary precautions associated with the operation of these systems. The final rule modifies the proposal in that the term ''device'' has been replaced by the term ''system'' to clarify that this requirement applies to the entire fire suppression system, not merely a component of it.

One commenter to the proposal agreed with the requirement that miners be trained in the hazards and safeguards of fire suppression systems, but recommended that such training be incorporated in the annual refresher training required under existing § 75.1101–23 for the program of instruction, location and use of fire fighting equipment. Under the final rule, it is anticipated that the instruction on the hazards of fire suppression systems required by this paragraph will be part of the § 75.1101–23 instruction.

Paragraph (l) of this section of the final rule provides that, for purposes of existing § 75.380(f), a fire suppression system installed on diesel-powered equipment and meeting the requirements of § 75.1911 is equivalent to a fire suppression system meeting the requirements of §§ 75.1107–3 through 75.1107–16.

Section 75.380 addresses requirements for escapeways in bituminous and lignite mines. Section 75.380(f) specifies the equipment that can be used in the primary escapeway and the type of fire suppression system required to be installed on this equipment. Section 75.380(f)(4) requires that each piece of mobile equipment operated in primary escapeways, except for continuous miners and as provided in paragraphs (f)(5), (f)(6) and (f)(7) of the section, be equipped with a fire suppression system installed according to §§ 75.1107–3 through 75.1107–16 that is: (1) manually operated and attended continuously by a person trained in the system's function and use; or (2) a multipurpose dry chemical type capable of both automatic and manual activation. The requirement in § 75.380(f)(4) for installation of a fire suppression system that meets the requirements of §§ 75.1107–3 through 75.1107–16 on equipment operating in the primary escapeway presents a potential conflict with the requirement for installation of a fire suppression system on diesel-powered equipment in § 75.1911.

As noted earlier, several commenters to the proposed rule believed that the requirements for fire suppression systems in §§ 75.1107–3 through 75.1107–16 should be made applicable to diesel-powered equipment. However, the requirements in §§ 75.1107–3 through 75.1107–16 make specific reference to electric equipment and components and are not practical for diesel-powered equipment. Any modification of these existing requirements by inserting the term ''diesel-powered'' in the regulatory language would result in an extremely confusing regulation.

After a review of the issue, MSHA has determined that fire suppression systems installed on diesel-powered equipment meeting the requirements of § 75.1911 afford at least equivalent protection to fire suppression systems meeting the requirements of §§ 75.1107–3 through 75.1107–16. Many of the requirements contained in §§ 75.1107–3 through 75.1107–16 are similar to those in § 75.1911. Both sections include requirements for: listed or approved fire

suppression systems; the capacity and size of fire suppression system hardware; a system design that will withstand the normal rigors of mining; compatibility of the extinguishing agent with the mine atmosphere; the system's ability to operate independently of an equipment power supply; sensor operability status indication; and the inclusion of manual actuators. Consequently, the final rule makes clear that fire suppression systems meeting the requirements of § 75.1911 will satisfy the requirements of § 75.380(f)(4).

Section 75.1912 Fire Suppression Systems for Permanent Underground Diesel Fuel Storage Facilities

This section of the final rule establishes requirements for the design, installation and maintenance of fire suppression systems at permanent underground diesel fuel storage facilities. Under the final rule, a permanent underground diesel fuel storage facility is defined as a facility designed and constructed to remain at one location for the storage or dispensing of diesel fuel, which does not move as mining progresses. Section 75.1903(a)(5) of the final rule requires that permanent underground diesel fuel storage facilities be equipped with an automatic fire suppression system that meets the requirements of § 75.1912.

The Diesel Advisory Committee recommended that automatic fire suppression systems be used to address potential fire hazards from ignition and fuel sources at permanent underground diesel fuel storage facilities. The proposed rule included design, installation and maintenance requirements for automatic fire suppression systems for diesel fuel storage areas and stationary diesel-powered equipment.

Commenters to the proposed rule generally accepted the need for fire suppression systems at permanent underground diesel fuel storage facilities. However, comments varied on what the requirements for fire suppression systems should be. Some commenters recommended that only manufacturer's requirements for design, installation and maintenance be used. Other commenters recommended a more detailed approach and suggested that the final rule outline specific requirements for fire suppression systems.

The storage of diesel fuel at permanent underground facilities presents a limited fire hazard when fuel is contained in diesel fuel tanks and safety cans constructed of noncombustible material. However, diesel fuel does present a fire hazard when it is spilled from a tank or leaked from a hose and comes into contact with an ignition source. Spills and leaks of diesel fuel at permanent underground storage facilities can occur when machinery is being refueled, when diesel fuel is being placed in or taken out of storage tanks, or when tanks are damaged or not properly maintained. Potential ignition sources at permanent underground storage facilities include a running diesel vehicle with hot surfaces or hot brake components, malfunctioning electric valves, or pumps used to dispense diesel fuel.

Fire suppression systems are designed to extinguish fires quickly, in their incipient stage, and to reach all locations where a fire may occur. This is important at permanent underground diesel fuel storage facilities because a fire must be extinguished quickly before fuel can further propagate a fire. For example, if a fire is not extinguished at an early stage, leaking diesel fuel can fuel a fire and result in an increase of the intensity and size of the fire.

Fixed fire suppression systems also offer two advantages over portable fire extinguishers: fast attack and application of the suppressant to difficult-to-reach areas where fires may occur. In addition, an automatic fire suppression system has the advantage of detecting and suppressing fires without a person in attendance. Because permanent underground diesel fuel storage facilities will not always be attended, it is necessary to require a means of electrically or mechanically detecting a fire as well as electrically or mechanically activating the fire suppression system upon fire detection. This is important since the potential hazard for mine personnel throughout the mine is significant if a fire in a diesel fuel storage facility could burn unnoticed.

The proposed rule would have established requirements for fire suppression devices for permanent underground diesel fuel storage areas and stationary unattended diesel-powered equipment. Because § 75.1916(d) of the final rule requires all diesel-powered equipment to be attended while operating, and because proposed requirements for stationary unattended equipment have not been adopted in the final rule, § 75.1912 of the final rule has been modified to apply only to permanent underground diesel fuel storage facilities.

A number of commenters to the proposal expressed concern with the requirements for fire suppression systems at permanent underground diesel fuel storage facilities. One commenter stated that since diesel fuel is a Class II combustible liquid, a diesel fuel storage station used and moved with a working section should be treated similar to a lubricating oil or grease storage station. This commenter expressed the view that requirements for limiting the quantity of diesel fuel in temporary storage and requiring portable fire extinguisher protection would be adequate safeguards. Another commenter expressed concern with the ability of a dry compound to suppress a fire over a long enough period of time to prevent re-ignition. This commenter stated that high volumes of ventilating air in a mine can blow dry compound away from the area it is attempting to protect before it can cool down a hot surface created by a fire.

MSHA agrees with the commenter who stated that diesel fuel stored on and moved with a section should be treated as a Class II combustible liquid. The final rule addresses this comment by establishing the allowance for one temporary underground diesel fuel storage area for the short-term storage and dispensing of diesel fuel on each working section, which can move as mining progresses. A temporary underground diesel fuel storage area is defined under § 75.1900 of the final rule as an area of the mine provided for the short-term storage of diesel fuel in a fuel transportation unit, which moves as mining progresses. These temporary underground diesel fuel storage areas are required to meet the requirements in §§ 75.1902, 75.1903 and 75.1906 of the final rule. All other diesel fuel storage areas will be treated as permanent storage facilities and must comply with all of the requirements for such facilities. Permanent diesel fuel storage facilities pose a higher risk of fire than oil and grease storage areas because diesel fuel is generally stored in much greater quantities in underground coal mines. In addition, diesel fuel has a lower flash point than either lubricating oil or grease and can be more easily ignited by a hot surface.

Although permanent diesel fuel storage facilities are provided with ventilating air during normal operations, these facilities are required under § 75.1903(a)(2) of the final rule to be equipped with either a self-closing door or a means for automatic enclosure upon actuation of the fire suppression system. This feature should prevent any ventilating air from affecting the suppressant agent.

An automatic fire suppression system uses a supplemental detection device to provide an early warning of a fire. The fire detection system, which is generally activated by either smoke or heat,

automatically sends a signal to the system for the discharge of suppressant agent. Automatic fire suppression systems activate a network of piping and nozzles to allow suppressant agent to be released and distributed directly at a predetermined fire hazard.

Under the final rule, automatic fire detection and fire suppression systems are required to provide fire suppression for all areas of a permanent underground diesel fuel storage facility. The final rule also requires that the system include audible and visual alarms to warn of fires or system faults and automatic electrical system shutdown in the event of a fire. In addition, the final rule requires all fire suppression systems to be tested and maintained in accordance with manufacturer's recommendations. Finally, the final rule establishes certain recordkeeping requirements for fire suppression systems that are found not to meet required specifications during inspection and testing.

Paragraph (a) of this section of the final rule requires that a fire suppression system required by § 75.1903(a)(5) be an automatic multipurpose dry chemical type (ABC) fire suppression system listed or approved as an engineered dry chemical extinguishing system by a nationally recognized independent testing laboratory and appropriate for installation at a permanent underground diesel fuel storage facility.

The proposed rule would have required an automatic multipurpose dry powder type fire suppression system suitable for the intended application and listed or approved by a nationally recognized independent testing laboratory.

A commenter to the proposal stated that this paragraph should require that ''an automatic fire suppression system suitable for the intended application shall be installed to protect the entire area inside the fire proof enclosure.'' This commenter believed that all of the necessary requirements for fire suppression systems were already addressed in existing part 75, and that it was unnecessary to identify protected coverage components inside the storage facility if the entire area is required to be protected. Another commenter stated that the requirement in the proposal that the ''system be suitable for the intended application'' was ambiguous and could be subject to different interpretations. This commenter stated that the term ''suitable'' could refer to a system that is suitable for a particular type of fire (class B or combustible liquid fire) or it could mean that the system has a sufficient capacity to extinguish a fire. This commenter also recommended that the final rule specify the capacity of fire suppression systems installed at permanent underground diesel fuel storage facilities.

In response to commenters, MSHA evaluated whether the requirements for fire suppression systems in existing § 75.1107 should be extended to apply to permanent underground diesel fuel storage facilities, but has concluded that such an extension would not be appropriate. The fire hazards that exist at permanent underground diesel fuel storage facilities are different from those on electric-powered equipment, due to the storage of large quantities of diesel fuel in close proximity to ignition sources at these facilities. Additionally, because existing § 75.1107 makes specific reference to electrical controls and components on electric-powered equipment, a modification of the existing requirements by inserting the term ''permanent underground diesel fuel storage facility'' in the regulatory language would result in an extremely confusing regulation. Existing fire suppression requirements in part 75 have therefore not been applied to permanent underground fuel storage facilities.

In response to commenters' suggestions, the final rule does not adopt the phrase ''suitable for the intended application'' from the proposal. Instead, the final rule includes the more specific language ''listed or approved as an engineered dry chemical extinguishing system approved by a nationally recognized independent testing laboratory.'' This modification is intended to clarify that an automatic fire suppression system installed at a permanent underground diesel fuel storage facility must be listed or approved by a nationally recognized independent testing laboratory specifically for a fixed engineered dry chemical extinguishing system unit.

The capacity and suitability of fire suppression systems for protecting against specific fire hazards are specified as part of the listing or approval by the nationally recognized independent testing laboratory. The listing or approval ensures that a fire suppression system is properly designed for a particular type of fire protection hazard by putting the system through a series of specific performance tests. The system must also meet rigid design requirements in order to gain listing or approval.

Fire suppression systems should be installed by a qualified individual following the installation and maintenance instructions in the system manufacturer's installation manual. The sizing of a fire suppression system is dependent upon the number of nozzles needed to adequately cover the entire area of a permanent underground diesel fuel storage facility. The number of dry chemical canisters required will be proportional to the amount of area that must be covered by the nozzles. This information can be obtained from the installation manual that is part of the listing or approval documentation. Other installation considerations, such as proper location and guarding of nozzles and other system components to prevent damage, are addressed in the system's installation manual. In addition to the installation requirements, the manual includes provisions for follow-up maintenance and inspection procedures.

One commenter to the proposal recommended that the term ''dry powder'' be deleted from paragraph (a) because this commenter believed that there were many equally effective systems, such as foam/water spray systems, available to protect against fire hazards. Another commenter stated that the terms ''listed'' and ''approved'' were not strong enough. This commenter stated that there was no way of verifying whether a system had been ''listed'' or ''approved'' and recommended that the term ''tested'' replace the term ''listed''.

Although dry chemical is the most commonly used type of suppressant agent in the mining environment and is specifically referenced in paragraph (a) of the final rule, paragraph (a)(1) of the final rule allows for alternate types of fire suppression systems that are no less effective. In addition, the requirement that a system be listed or approved by a nationally recognized independent testing laboratory is more stringent than using the term ''tested''. Under the final rule, when a system is listed or approved by a nationally recognized independent testing laboratory, it means that the system has met performance and design requirements outlined in an industry standard in a certain configuration and for a specific function. Also, if a system has been listed or approved by a nationally recognized independent testing laboratory, it means that the system has met other requirements for inspection, maintenance, and quality control assurances.

Also modified in this paragraph from the proposal is the term ''chemical'' replacing the term ''powder'' and the addition of the reference ''ABC'' for the three classes of fire. These modifications were made in response to commenters' request for clarification and to incorporate more appropriate terminology.

A multipurpose dry chemical type agent is the most commonly used and successfully applied type of suppressant agent in fire suppression systems in underground coal mines. This type of agent is specifically designed to extinguish ABC class fires. A class A fire refers to a fire of combustible solid materials such as paper, rubber, textiles, and cloth, and would involve such items as hosing at a permanent underground diesel fuel storage facility. A class B fire would include diesel fuel. Class C fires involve electrical components and could include such components as lights, pumps, and valves at permanent underground diesel fuel storage facilities.

The term ''engineered'' was added to the final rule in response to commenters' concerns regarding the adequacy of a fire suppression system to address all of the fire hazards at a permanent underground diesel fuel storage facility. An engineered fire suppression system will ensure that all of the fire hazards are addressed since a representative from a fire suppression system manufacturer will go to the facility and evaluate all of the fire hazards. The evaluation by the system manufacturer representative also includes determining the appropriate coverage areas for the fire suppression system, the number and size of dry chemical canisters, the length of piping, and the number of nozzles.

The proposed rule would have allowed the use of inert or halogenate gas suppressant agents in unoccupied and enclosed areas where the use of such suppressants would not pose a toxic hazard. One commenter to the proposal recommended that the use of inert or halogenate gas suppressant agents be prohibited because they create a toxic hazard. This requirement has not been included in the final rule because inert or halogenated gas fire suppression systems are considered an alternate type of fire suppression system that are addressed in paragraph (a)(1) of this section of the final rule. The potential toxic hazard presented by inert or halogenated gas suppressant agent will be evaluated by MSHA on a case-by-case basis as an alternate type system. In addition, typical inert gas agents such as halon 1211 and 1301 are no longer being marketed due to their reported contribution to the ozone depletion of the environment.

Paragraph (a)(1) of the final rule adopts the provision from the proposal that alternate types of fire suppression systems be approved in accordance with § 75.1107–13 of this part. This paragraph of the final rule is intended to allow the use of fire suppression systems other than dry chemical systems, so long as they provide substantially equivalent protection. Under the final rule, MSHA will evaluate alternate types of fire suppression systems, such as foam/water sprinkler-based systems, using the criteria set forth in existing § 75.1107–13.

One commenter to the proposal objected to this provision and stated that only the manufacturer who designs and constructs these systems will know the exact capabilities and limitations of the system. This commenter also stated that this requirement would result in the installation of inadequate fire suppression systems at permanent underground diesel fuel storage facilities, because the requirements in existing § 75.1107–13 are applicable to fire suppression systems installed on equipment.

Existing § 75.1107–13 establishes criteria for the approval of alternate fire suppression devices. Under § 75.1107–13, the appropriate MSHA district manager may approve any fire suppression system or device which provides substantially equivalent protection to what would be achieved through compliance with the standard.

The final rule does not intend to allow alternate types of fire suppression systems that do not adequately address fire hazards at permanent underground diesel fuel storage facilities. Instead, all types of alternate fire suppression systems must be installed and operated in strict accordance with the system manufacturer's recommendations as specified in paragraph (a)(2) of this section of the final rule. Any type of fire suppression system that is not designed and constructed in accordance with industry standards for fire protection will be unacceptable.

Paragraph (a)(2) of the final rule adopts the requirement from the proposal that the suppression system be installed in accordance with the manufacturer's specifications and the limitations of the nationally recognized independent testing laboratory listing or approval. One commenter to the proposal expressed the view that the term ''listing'' was not specific enough and recommended that the language ''independent testing'' be added. As explained earlier, a listing or approval by a nationally recognized independent testing laboratory is more stringent than the use of the term ''testing''. This comment has therefore not been adopted in the final rule.

This requirement ensures that the system is installed within the limits defined by the listing or approval issued by the nationally recognized independent testing laboratory and as specified by the fire suppression system manufacturer. Since the system is performance-tested to a specific standard and in certain configurations, it must be installed within these parameters to be effective.

Paragraph (a)(3) adopts the requirement from the proposal that the fire suppression system be installed in a protected location or guarded to prevent physical damage from routine operations. Damage to any part of the fire suppression system can result in a malfunction of the entire system and in the system not responding to fire hazards. For example, a rock fall can pinch a hose or crush a sensor and create faults that can disable the entire system or a portion of the system.

One commenter stated that the proposed rule did not define what protections were necessary on fire suppression systems and suggested that the systems be fully protected from physical elements, including rib and roof falls. This commenter further stated that this protection is already provided for electrical circuit breakers under existing § 75.901, and that this type of protection is even more vital for the protection of fire suppression systems.

This comment has not been adopted in the final rule because the construction requirements for permanent underground diesel fuel storage facilities at §§ 75.1902 and 75.1903 ensure that fire suppression systems will be protected from the general hazards of the mine environment. The installation requirements in this paragraph ensure that additional protection will be provided for specific system components.

Paragraph (a)(4), like the proposal, requires that the suppressant agent distribution tubing or piping be secured and protected against damage, including pinching, crimping, stretching, abrasion, and corrosion. No specific comments were received on this aspect of the proposal. During the normal mining activity in and around a permanent underground diesel fuel storage facility, a fire suppression system can become damaged from collisions with mining equipment or from daily mining operations. This requirement ensures that fire suppression system components are kept in proper working order and that the entire system remains ready to discharge fire suppressant to the entire area of a permanent underground diesel fuel storage facility.

Paragraph (a)(5) adopts the requirement from the proposal that fire suppression nozzles be protected against the entrance of foreign materials.

No specific comments were received on this aspect of the proposal. The nozzles used on multipurpose dry chemical fire suppression systems can be as small as ⅛ of an inch. If material such as mud, coal dust, or rock dust enters the nozzle, it can prevent the chemical agent from discharging entirely, or alter the pattern and coverage of fire suppressant.

Paragraph (b) of this section of the final rule requires that the fire suppression system provide automatic fire detection and automatic suppression for all areas within a permanent underground diesel fuel storage facility. The proposal would have required automatic fire detection and fire suppression for fuel storage tanks, containers, safety cans, pumps, electrical panels and control equipment in fuel storage areas. The requirement in the final rule responds to commenters'' recommendations that automatic fire detection and suppression be provided for all areas within a permanent underground diesel fuel storage facility enclosure.

Although the listing or approval generally describes certain areas that may pose a fire hazard, it does not specifically identify which hazards must be covered by fire suppression. Fire suppression coverage for the entire area of a permanent underground diesel fuel storage facility is necessary because of the potential fire hazard created by numerous ignition and fuel sources. The proposed coverage of only certain specific hazards within a diesel fuel storage facility would have resulted in other potential hazards not being addressed. Under the proposal, it would have been possible for a fire to begin in one area of the facility that was not specifically covered by fire suppression. Under these circumstances, a fire could be difficult to contain if large quantities of leaked diesel fuel are present throughout the facility. The final rule requires the entire area of a diesel fuel storage facility to be covered because of the likely spread of a fire if a diesel fuel leak develops.

Paragraph (c) of the final rule requires that audible and visual alarms to warn of fire or system faults be provided at the protected area and at a surface location which is continually monitored by a person when personnel are underground. The final rule also requires that, in the event of a fire, personnel be warned in accordance with the provisions set forth in § 75.1101–23. This requirement is intended to provide a means for immediate notification of personnel in the area of a permanent underground diesel fuel storage facility when the fire suppression system detects a fire or identifies a problem with the system. The audible and visual indication of fire detection is important because it alerts personnel in and around the area of a permanent underground diesel fuel storage facility that a fire exists and that a chemical agent is being discharged. The requirement for audible and visual indication of fault detection is established in order to alert personnel working in and around diesel fuel storage facilities that a problem exists with the fire detection system so that the defect can be addressed.

The proposal would have required that audible and visual alarms to warn of fire or system faults be provided at the protected area and at a surface location which is always staffed when personnel are underground who could be endangered by a fire. In addition, the proposal would have required that a means also be provided for warning all endangered personnel in the event of a fire.

Several commenters to the proposal expressed concern over this requirement, stating that the requirement for visual and audible alarms at a surface location would be impractical for many small operators because it would result in operators maintaining a monitoring system to detect fires. These commenters recommended that fire suppression systems be examined regularly to determine system faults, and that audible and visual alerts should only be required at locations where miners are present. Another commenter stated that mines have become lax in responding to fire warnings. One commenter recommended that a formal procedure be established to warn personnel in the event of a fire, and that this procedure should be submitted to MSHA for approval and be included in the mine emergency fire fighting and evacuation plan and in the miners'' annual refresher training. Other commenters stated that the proposed phrase ''always staffed'' does not ensure that a qualified or responsible person will be designated to alert mine personnel underground in the event of a fire. One commenter suggested that the language ''always staffed'' be changed to ''someone who is qualified.''

The continual monitoring by a person on the surface of fire detection and fire suppression system faults is not a burdensome requirement given the chance that a fire or system fault may otherwise go unnoticed. The early warning of a fire at a permanent underground diesel fuel storage facility is critical, due to the presence of numerous ignition sources and large quantities of diesel fuel. If communication is not available, fire fighting efforts can be hampered and the fire can spread. Also, if a program is not instituted to warn of a fire, personnel located in other areas of the mine can be put at risk of being cut off from escape. In addition, faults in fire suppression systems need to be identified and communicated to maintenance personnel so that system defects can be corrected. If an automatic fire suppression system is not functioning properly and a fire breaks out, it could result in a serious hazard since the fire would not be extinguished in its incipient stage. The inspection and maintenance requirements for fire suppression systems specified under the final rule should ensure the reliability of the system and minimize the occurrence of false alarms.

The final rule responds to commenters by providing flexibility in the method used to alert mine personnel that a fire exists at a permanent underground diesel fuel storage facility. Under the final rule, when a fire is detected, personnel are to be warned in accordance with the provisions set forth in existing § 75.1101–23. Section 75.1101–23 requires that each operator of an underground coal mine adopt a program for the instruction of all miners in fire fighting and evacuation. The program of instruction is submitted to the appropriate MSHA district manager for approval on a mine-by-mine basis. By including the requirement for early warning of fires at permanent underground diesel fuel storage facility in § 75.1101–23, the final rule allows this important communication provision to be developed by taking into consideration mine-specific conditions.

This section of the final rule also requires that a person be assigned on the surface whose duties include receiving notification of fire detection and alerting underground personnel that a fire has been detected. The final rule does not specify any qualification or training for the person designated on the surface. However, the instruction of all mine personnel, including the designated person staffed at a surface location, is a critical element of an early warning fire response strategy and is the responsibility of the mine operator under § 75.1101–23.

Paragraph (d) of this section of the final rule requires that the fire suppression system deenergize all power to the diesel fuel storage facility when actuated except that required for automatic enclosure and alarms. This requirement was added to the final rule in response to commenters' concerns regarding reignition of fires caused by electrical failures. As stated earlier, fire

suppression systems are designed to suppress fires in their incipient stage. If the ignition source and fuel sources remain present after the fire suppression system has been actuated, the fire can reignite. Shutting off any unnecessary electrical power to the facility will remove a potential ignition source and reduce the likelihood that the fire will reignite.

The Ontario accident data for fires on diesel equipment supports the need for shutting off ignition sources to prevent reignition. This hazard is just as significant for diesel fuel storage facilities, since potential electrical ignition sources are present with large quantities of diesel fuel. The final rule is also consistent with existing § 75.1107–4, which requires that the electric power source to the protected equipment be disconnected when the fire suppression system is actuated.

This requirement also applies to any fuel transportation unit located in a permanent diesel fuel storage facility that is equipped with an electric panel and controls directly connected to an electrical power source.

Paragraph (e) of the final rule, like the proposal, requires that fire suppression systems at permanent underground diesel fuel storage facilities be equipped with two manual actuators. The final rule requires that at least one actuator be located within the fuel storage facility and at least one actuator be located a safe distance away from the facility in intake air, upwind of the storage facility. The final rule is intended to ensure that at least two manual actuators be provided in locations that are accessible to mine personnel working in or around a permanent diesel fuel storage facility. This requirement is similar to the fire extinguisher location requirements for underground fuel storage facilities and areas in § 75.1903(b)(1) and (b)(2) of the final rule, which provide that at least one portable fire extinguisher be located outside of the storage facility or area upwind of the facility, in intake air, to enable miners to reach the actuator in the event of fire. To allow flexibility in complying with the requirements of this paragraph, what constitutes a ''safe distance from the facility'' has not been specified in the final rule. The location of the actuator outside the facility should be determined based on mine conditions and the particular usage of the facility.

Commenters generally expressed support for this aspect of the proposal. One commenter recommended that a requirement be added to address manual application of water in lieu of manual actuators when sprinkler systems are used. Another commenter suggested that actuators be separated from each other, and specifically recommended that a check valve be used to ensure that one faulty actuator does not circumvent or defeat the use of the other actuator.

The final rule specifically addresses only requirements for dry chemical fire suppression systems, and a water sprinkler type fire suppression system would be considered an alternate type of fire suppression system under paragraph (a)(1) of this section. As a result, the final rule does not adopt the suggestion that an additional requirement be added to address manual application when water sprinkler systems are used. In addition, the final rule does not include a requirement for a check valve between the actuators for fire suppression systems. This is considered part of the system design and is more appropriately addressed by the system manufacturer and the listing or approving nationally recognized independent testing laboratory.

Paragraph (f) of the final rule adopts the requirement from the proposal that the fire suppression system remain operational in the event of an electrical system failure. No specific comments were received on this aspect of the proposal. This requirement is intended to ensure that the system will be functional if power from external sources is lost. The phrase ''engine shutdown'' has not been adopted from the proposal, because the phrase would have applied to fire suppression system requirements for unattended diesel-powered equipment. Because the final rule does not permit the operation of unattended diesel-powered equipment, this phrase is no longer necessary.

Paragraph (g) adopts the requirement from the proposal that electrically operated detection and actuation circuits be monitored and provided with status indicators showing power and circuit continuity. The final rule also requires that automatic detection systems be provided with a means to indicate the functional readiness status of the detection system. This paragraph requires that the fire suppression system provide a means of notifying miners and maintenance personnel of the functional readiness status of both the detection and actuation circuit and the power source. This paragraph also requires that automatic systems not electrically operated provide a means of notifying the operator or maintenance person of the functional readiness of the system.

This requirement is included in the final rule to ensure the continuity of electrical systems used to detect faults on fire suppression systems. This requirement will serve to alert miners and maintenance personnel when a fire suppression system is not in a state of readiness due to an electrical system fault. The continuity of the electrical system used to detect fires and actuate the system is important since an automatic system is based on early detection and automatic actuation.

One commenter to the proposal stated that the fire suppression system should also be protected as specified in § 75.1101–17, which requires that each dry powder chemical system be adequately sealed to protect all components of the system from moisture, dust, and dirt.

The protection of the fire suppression system components from moisture and dust is adequately addressed by the requirements of paragraphs (a)(3), (a)(4) and (a)(5) of this section of the final rule. In addition, the listing or approval typically includes requirements for a dust shield and checks of the powder for dryness.

Paragraph (h) of the final rule adopts the requirement from the proposed rule that each fire suppression system be tested and maintained in accordance with the manufacturer's recommended inspection and maintenance program and as required by the nationally recognized independent testing laboratory listing or approval, and be visually inspected at least once each week by a person trained to make such inspections.

The proposed rule would have required each fire suppression device to be visually inspected at least once each week by a person qualified to make such inspections. The proposal also would have required that each fire detection device be tested and maintained in accordance with applicable requirements in § 75.1100.

Commenters to the proposal generally expressed support for maintenance of fire suppression systems installed at permanent underground diesel fuel storage facilities. A number of commenters, however, recommended that a maintenance program specifically designed for fire suppression systems be developed at each mine. One commenter to the proposal expressed concern over the requirement for weekly visual inspections of fire suppression systems at permanent underground diesel fuel storage facilities. This commenter recommended that there be frequent functional testing of the suppression systems to ensure that lines are not blocked or pinched. Another commenter stated that the proposal did not specify the types of tests that should be conducted on fire suppression systems at permanent underground

diesel fuel storage facilities. Other commenters expressed concern over the frequency of tests and inspections. These commenters recommended that detailed inspections and functional tests be conducted semiannually or quarterly. One commenter recommended that fire suppression systems be treated in the same manner as portable fire extinguishers and that inspections be conducted once a week and physically tested twice a year.

Under the final rule, the weekly visual inspection is not intended to be an in-depth examination. The weekly visual inspection is intended to be a quick check to verify that there are no obvious defects, such as disconnected hose lines or altered nozzles. An in-depth inspection takes place as part of the manufacturer's recommended testing and inspection procedure also required under the final rule. Fire suppression system manufacturers are most familiar with the design and operation of their systems and are best able to identify the components that need maintenance, the type of maintenance needed, and the frequency of maintenance. Adequate maintenance is essential because of the importance of these systems in fire protection. The maintenance and testing requirements for fire suppression systems are in addition to the requirement set forth for a weekly visual inspection.

The manufacturer's inspection and maintenance procedures are spelled out in great detail in the manufacturer's manual and include the recommended inspection intervals, which depend on the environment in which the system operates. In addition, these inspection and maintenance procedures are evaluated as part of the system's approval or listing by a nationally recognized independent testing laboratory.

This paragraph is identical to the requirement in § 75.1107–16(a). As stated earlier, the fire suppression system requirements in §§ 75.1107–3 through 75.1107–16 cannot be directly applied to diesel equipment because the fire hazards presented by diesel fuel are different from those on electric-powered equipment, due to the close proximity of large quantities of diesel fuel to potential ignition sources.

Also modified in this paragraph is the replacement of the term ''device'' with the term ''system''. This was done because MSHA intends that the whole system be inspected, not just individual components of a system.

A person ''trained'' to perform the inspections and tests required by paragraph (h) of this section of the final rule is not required to be a qualified person under § 75.1915. However, the final rule intends that the person performing tests and inspections of fire suppression systems have sufficient knowledge to determine whether a fire suppression system is functioning properly. MSHA anticipates that since fire suppression systems are common to both electric and diesel equipment, the mine operator will work with either the fire suppression system manufacturer or distributor to ensure that persons responsible for the maintenance of fire suppression systems are adequately trained.

Paragraph (i) of the final rule establishes recordkeeping requirements for the inspection and maintenance requirements for fire suppression systems set forth in paragraph (h), and requires that persons performing inspections and tests of these systems record results of tests and inspections only when a system does not meet the installation or maintenance requirements of this section. Under these circumstances, the person performing the inspection or test is required to indicate the fuel storage facility where the fire suppression system did not meet the installation or maintenance requirements of this section, the defect found, and the corrective action taken. The final rule also requires that these records be kept either manually or electronically in a secured manner that is not susceptible to alteration. In addition, the final rule requires that records be maintained at a surface location at the mine for one year and made available for inspection by an authorized representative of the Secretary and by miners representatives.

The proposal would have required that a record be kept of all of the inspections of fire suppression systems and maintained at an appropriate location for each fire suppression device. One commenter to the proposal recommended that the records required by this section be made available to all interested parties and that this information be centrally located on the surface of the specific mine.

Office of Management and Budget guidance comments directed MSHA to reexamine the recordkeeping requirements in the proposal and recommended that the final rule require paperwork that was the least burdensome necessary. MSHA has done so, and the final rule does not adopt the proposal that all fire suppression system test and maintenance results be recorded. In response to commenters and consistent with other provisions of the final rule, paragraph (i) requires that records of inspections and tests be made only when a fire suppression system does not meet the installation or maintenance requirements of this section. This requirement is important because if a fire suppression system does not meet its listing or approval, the defect can be of a nature and seriousness that the system can fail when a fire begins. This requirement is intended to ensure that records are maintained and made available to interested parties when a defect is found, and that the appropriate level of mine management is made aware of defects requiring attention.

The final rule does not specify a particular way of recording the test and maintenance data, only that it be located at the surface of the mine. The records of the inspections and tests must be made in a secure media not susceptible to alteration. A detailed discussion of the subject of acceptable record books and electronic records can be found under the heading ''Recordkeeping Requirements'' in the General Discussion section of this preamble.

The final rule does not adopt the requirement from the proposed rule that records of inspections be maintained at an appropriate location near each fire suppression system. Instead, paragraph (i)(3) of this section of the final rule establishes the requirement recommended by a commenter that records of inspections and tests be maintained at a surface location at the mine. Storing records on the surface at the mine makes them more accessible to interested parties. Also in response to commenters, the final rule provides access not only to miners representatives but to authorized representatives of the Secretary. This provision ensures that test and inspections of fire suppression systems are being made and, when a defect is found, corrective action is taken.

Paragraph (j) adopts the proposed requirement that all miners normally assigned in the active workings of the mine be instructed about the hazards inherent to the operation of fire suppression systems, and where appropriate, the safeguards available for each system. This requirement is intended to ensure that all miners working in areas where fire suppression systems operate are instructed in any inherent hazards and necessary precautions associated with the operation of these systems. The final rule modifies the proposal in that the term ''device'' has been replaced by the term ''system'' to clarify that this requirement applies to the entire system rather than to system components.

One commenter to the proposal agreed with the requirement that miners be trained in the hazards and safeguards

of fire suppression systems, but recommended that such training be incorporated in the annual refresher training required under existing § 75.1101–23 for the program of instruction, location and use of fire fighting equipment. Under the final rule, it is anticipated that the instruction on the hazards of fire suppression systems required by this paragraph will be part of the § 75.1101–23 instruction.

Section 75.1913—Starting Aids

This section addresses the storage and use of volatile fuel starting aids for diesel-powered equipment. The requirements of the final rule are similar to the requirements contained in the proposal, with some minor modifications. This section places limitations on the use and storage of volatile fuel starting aids underground, to minimize the risks of fire or explosion. Under the final rule, volatile fuel starting aids must be used in accordance with recommendations of the starting aid manufacturer, the engine manufacturer, and the machine manufacturer. The final rule also includes requirements for the storage of volatile fuel starting aids, and prohibits the use of starting aids under certain circumstances, such as in areas where permissible equipment is required or where 1.0 percent or greater concentration of methane is present. Connection of compressed oxygen or compressed flammable gases to diesel air-start systems is also prohibited.

The Diesel Advisory Committee recognized that improper storage and handling of starting aids could present fire and explosion hazards in underground coal mines. The Committee therefore recommended that MSHA regulate the storage and use of starting aids. The proposed rule set forth limitations on the use of starting aids, to minimize the hazards associated with their use in the underground coal mine environment. The requirements of the final rule reflect MSHA's determination that volatile fuel starting aids can be safely used underground if appropriate precautions are taken.

Volatile fuel starting aids, normally ethyl ether, facilitate the starting of diesel engines in cold temperatures. In very cold weather the compression ignition of diesel engines cannot easily reach the high temperature necessary to ignite diesel fuel. This makes it difficult, and in some cases impossible, to start the engine without special measures, such as the use of volatile fuel starting aids. Volatile fuel starting aids sprayed into a cold diesel engine help to start the engine because they ignite at a much lower temperature than diesel fuel. Starting aids that are ignited in a diesel engine will both heat up the cylinder walls of the engine and start the engine spinning, resulting in easier ignition of the diesel fuel.

The use and storage of volatile fuel starting aids in underground coal mines present safety hazards, due to the starting aids' high volatility. When these substances are stored or used improperly, they can present a very real danger of fire or explosion, particularly in the underground coal mine environment.

Commenters were divided on whether the use of starting aids should be permitted in underground coal mines. Some commenters recommended a complete prohibition of the use of volatile fuel starting aids underground, stating that starting aids are extremely flammable, have a very low flash point, and can be ignited by any source of heat in the mine. These commenters believed that there were already numerous potentials for fire in the underground coal mine environment, and that permitting the use of starting aids would introduce another unnecessary hazard into that environment. Some commenters believed that starting aids were used at some mines as a substitute for effective maintenance of diesel engines, and that a properly maintained engine should be able to start on its own, without the boost that a starting aid provides.

Other commenters advocated allowing the use of starting aids but strictly controlling their use. Several commenters stated that starting aids were currently being used safely and effectively in their mines, and that any hazards arising from their use could be controlled by careful handling. These commenters stated that proper maintenance of diesel engines does not prevent starting difficulties in cold temperatures. One commenter observed that air temperatures at mines located at elevations of 9,000 or 10,000 feet can fall well below 0° F. Several commenters observed that a diesel-powered machine that has been shut down and has been sitting in cold weather, such as over a weekend, can be virtually impossible to start without the use of a starting aid.

Some of the commenters who favored prohibiting the use of volatile fuel starting aids underground stated that starting aids sometimes were used as a substitute for effective maintenance. Although an engine that has not been properly maintained could in some cases be started more easily with starting aids, this fact alone does not compel the prohibition of volatile fuel starting aids in underground coal mines. The final rule requires regular maintenance and testing of diesel-powered equipment, designed to ensure that the equipment is kept in good operating condition. Compliance with these requirements should eliminate any need to use starting aids as a replacement for effective equipment maintenance.

Paragraph (a) of this section requires that volatile fuel starting aids be used in accordance with the recommendations of the starting aid manufacturer, the engine manufacturer, and the machine manufacturer. The proposed rule would have required that volatile fuel starting aids be used in accordance with the specific recommendations in the engine manufacturer's maintenance and operations manual.

Several commenters noted that the written documentation from machine or engine manufacturers does not always address correct use of volatile fuel starting aids, and expressed their concern that starting aids could create serious hazards if not used in conformance with specific recommendations. In response to these comments, the final rule provides that starting aids must also be used in accordance with the recommendations of the starting aid manufacturer, ensuring that mine operators will at a minimum be guided by those instructions. Starting aid manufacturers are already required by Occupational Safety and Health Administration regulations to develop Material Safety Data Sheets (MSDS) for their products. To comply with this provision the mine operator should obtain an MSDS and any other product safety and use information prepared by the starting aid manufacturer on the safe use of that particular starting aid, and use the starting aid in accordance with those instructions.

Because engine and machine manufacturers are in the best position to determine whether volatile fuel starting aids can be safely and effectively used with a particular engine or machine, the final rule also requires mine operators to use starting aids in accordance with any available recommendations from the engine and machine manufacturers on the safe use of starting aids. This requirement recognizes that volatile fuel starting aids can damage engine or machine components and result in the failure of machine safety devices or increase exhaust emissions. For example, a buildup of the starting aid in intake or exhaust components could result in an explosion. Use of starting aids in accordance with the recommendations of engine and machine manufacturers will minimize

any safety hazards and avoid damage to the engine or machine, such as damage to intake or exhaust components, especially on permissible equipment.

Although the final rule is not intended to prohibit the use of starting aids if such information has not been developed by the machine or engine manufacturer, MSHA encourages diesel-powered engine and machine manufacturers who do not already do so to develop recommendations on the use of volatile fuel starting aids with the engines and machines they produce.

Paragraph (b) requires that containers of volatile fuel starting aids be conspicuously marked to indicate their contents. This paragraph further requires that containers of volatile fuel starting aids that are not in use be stored in metal enclosures that are used only to store starting aids. The metal enclosures themselves are required to be conspicuously marked, secured, and protected from damage.

The requirement that starting aid containers be conspicuously marked was not included in the proposal, but has been incorporated in the final rule in response to commenters' concerns over the serious dangers that could result if starting aids containers were damaged in any way. The container marking requirement is intended to prevent inadvertent damage to containers by ensuring that mine personnel are aware of the containers' contents. Labels that are affixed to the starting aid can by the starting aid manufacturer will satisfy the requirement for container marking.

The final rule also requires that enclosures for containers of starting aids be made of metal, marked, secured, and protected from damage, and used only for the storage of starting aids. The proposed rule would have required only that starting aids be stored in a fire proof enclosure when not in use. The final rule includes additional requirements to address commenters' concerns that starting aid containers could be inadvertently damaged, resulting in the unintentional release of the highly flammable starting aid. These additional requirements are similar to the requirements in the final rule that apply to safety cans containing diesel fuel that are transported on vehicles. Because both volatile fuel starting aids and diesel fuel present a possible fire hazard, the final rule imposes similar precautions for the handling and storage of these substances. The final rule also prohibits any other items, such as tools, from being stored with volatile fuel starting aids. This prohibition responds to commenters' concerns that containers of volatile fuel starting aids could be damaged through contact with other items, resulting in the release of the starting aid and the creation of a potentially hazardous situation.

Some commenters noted that the term ''fire proof enclosure'' used in the proposed rule was not defined anywhere in the regulations, and recommended the substitution of the term ''noncombustible''. Other commenters opposed the use of the term ''noncombustible'' because of their concern that a container that is simply noncombustible may not be substantial enough to protect starting aid containers. MSHA agrees with commenters who believe that the term ''fire proof'' is ambiguous, and also with commenters who oppose the substitution of the term ''noncombustible'' for the term ''fire proof'' because containers that are ''noncombustible'' may not be sufficiently durable. The final rule therefore requires that containers of starting aids be stored when not in use in metal enclosures, which are not only noncombustible but also sturdy enough to protect the starting aid containers that are stored there.

Paragraph (c) adopts the requirements of the proposal, and imposes specific restrictions on where and under what circumstances volatile fuel starting aids may be used in underground coal mines, to minimize any hazards presented by their use. Paragraph (c)(1) prohibits volatile fuel starting aids from being taken into or used in areas where permissible equipment is required. Volatile fuel starting aids can create flames that flame arresters, which are designed to provide protection against methane ignitions, cannot stop. Use of volatile fuel starting aids in an area where permissible equipment is required could lead to an ignition of any methane in the area. Use of starting aids in those areas is therefore forbidden in the final rule.

Paragraph (c)(2) prohibits the use of volatile fuel starting aids in the presence of open flames or burning flame safety lamps, or when welding or cutting is taking place. As noted by several commenters, vapors from volatile fuel starting aids are easily ignited. The final rule requires that volatile starting aids be kept away from the potential ignition sources of open flames or welding or cutting. Starting aids are also prohibited in the presence of burning flame safety lamps. The gauze in a flame safety lamp, although safe for use in the presence of methane, will not prevent the propagation of the flame by the ether vapors given off by the starting aid. The final rule is intended to prohibit these ignition sources in the immediate vicinity of any area where volatile fuel starting aids are being used.

Paragraph (c)(3) adopts the proposal to prohibit the use of volatile fuel starting aids in any area of the mine where 1.0 percent or greater concentration of methane is present. This requirement minimizes the possibility that starting aid vapors that have accidentally been ignited would spread to methane in the surrounding area. Permissible equipment may not prevent a flashback of fire that could ignite a methane atmosphere.

The proposed rule would have prohibited the use of starting aids in areas of the mine where 1.0 percent or greater of methane is detected. The final rule has been clarified to reflect that volatile fuel starting aids must not be used where 1.0 percent or greater of methane is ''present'', thereby placing on the mine operator the responsibility of ensuring that methane levels are within acceptable limits before volatile fuel starting aids are used.

Paragraph (d) imposes limitations on the use of compressed gases as starting aids for diesel-powered engines. The final rule adopts the proposal's prohibition of the connection of compressed oxygen or compressed flammable gases to diesel air-start systems. Commenters generally supported this restriction. The use of compressed oxygen in the presence of engine lubricants, which are normally in diesel air start-systems, presents an immediate danger of a fire. The final rule consequently forbids the use of compressed oxygen for this purpose. Additionally, the introduction of compressed flammable gases into the machine's compressed air system presents not only the same fire hazard as compressed oxygen, but also a danger of explosion from flammable gases being placed in close proximity to possible sparks from the diesel engine. The final rule therefore also prohibits the use of compressed flammable gases in diesel air-start systems. Nonflammable gases, such as nitrogen, are permitted for this purpose.

Section 75.1914 Maintenance Of Diesel-Powered Equipment

Section 75.1914 sets forth maintenance, repair and testing requirements for diesel-powered equipment, and also indicates the level of training or qualification a person must have to perform these important tasks. The rule generally requires that diesel-powered equipment be maintained in safe and approved condition, and specifically requires weekly equipment examination, weekly testing and evaluation of gaseous

emissions, flushing and draining of scrubbers, and changing of air filters. A person must be qualified under § 75.1915 to perform maintenance and repairs of approved and other specified features on diesel-powered equipment, and to conduct weekly equipment tests and examinations. However, the rule allows other functions required under this section to be performed by a person not qualified under § 75.1915, so long as the person has been trained in the task.

This section of the final rule recognizes that effective equipment maintenance is an indispensable element in reducing the health and safety hazards of diesel-powered equipment, and that adequate training of maintenance personnel is an important part of ensuring that such work is performed correctly. The purpose of the requirements of this section is to ensure that diesel-powered equipment is properly maintained so that it does not deteriorate through neglect, abuse, or normal use and result in a safety or health hazard to miners.

Virtually all commenters to the proposed rule supported the need for maintenance requirements for diesel-powered equipment used in underground coal mines. Commenters agreed that regular maintenance and routine examination of equipment is essential, as the performance of even the best-designed equipment will decline over time without proper maintenance. Inadequate maintenance of diesel equipment can result in the creation of fire or explosion hazards, and the levels of harmful gaseous and particulate components in diesel exhaust can increase when equipment is poorly maintained.

Several commenters to the proposed rule provided specific examples of the problems and hazards that result when maintenance personnel are poorly trained. Some commenters stated that inadequately trained personnel frequently failed to maintain diesel equipment in approved condition, causing the engines to deteriorate and resulting in increased levels of harmful exhaust gases. Commenters also reported that untrained persons were more likely than properly trained persons not only to allow safety systems to malfunction in the first place, but also to bypass the malfunctioning safety system in order to continue operating the machine, rather than to repair the system.

Paragraph (a) of this section retains the language of the proposed rule and requires that all diesel-powered equipment used in underground coal mines be maintained in approved and safe condition or removed from service. Several commenters recommended that the word ''approved'' be deleted, in the belief that it would be acceptable to use permissible equipment in non-approved condition when the machine was being operated in an outby location.

Paragraph (a) of the final rule prohibits the use of diesel equipment that is not in approved and safe condition. This prohibition includes the operation of permissible diesel-powered equipment in outby areas when an approved feature has been disabled. There are several reasons that this requirement has been adopted in the final rule. Many types of approved diesel equipment are extremely mobile, moving easily from areas of the mine where permissible equipment is required to areas where it is not, and there is nothing to distinguish a piece of diesel-powered equipment that has not been maintained in permissible condition from one that has. Both bear MSHA approval plates. Additionally, temperature sensors and other safety system components on diesel-powered equipment can be permanently damaged by exposure to high temperature exhaust gas when the equipment is not maintained in approved condition and a safety system is bypassed. The final rule therefore requires that equipment be maintained not only in safe condition but also in approved condition.

Paragraph (b) requires that maintenance and repairs of approved features, and the features required by §§ 75.1909 and 75.1910, be made only by a person qualified under § 75.1915. The final rule retains the concept of the proposal that the maintenance and repair of certain features of diesel-powered equipment be performed by a qualified person. The majority of commenters supported mandatory training and some form of qualification for those individuals performing these functions because it would help to ensure that diesel equipment is adequately maintained and kept in good operating condition. The Diesel Advisory Committee also recommended that qualified persons be responsible for the more complicated systems on the machine, such as the approved components.

A more extensive level of training is needed to ensure that persons working on more complex equipment features are adequately skilled. Additionally, MSHA machine approval requirements are largely performance-oriented, and equipment manufacturers consequently have significant latitude in designing their equipment to satisfy MSHA's permissibility requirements. Because a variety of equipment designs could accomplish the safety objectives mandated by an MSHA approval, approved equipment does not always conform to easily recognizable standards, and the ability to perform maintenance and repair work on the more complex features of diesel-powered equipment requires a comprehensive understanding of the equipment's design. The final rule therefore adopts the requirement of the proposal that persons performing work on certain specified features of diesel-powered equipment be qualified under § 75.1915, which requires completion of a training program developed by the mine operator.

The proposed rule specified only that ''approved features'' must be maintained and repaired by a person qualified under § 75.1915, and did not include within its scope ''features required by §§ 75.1909 and 75.1910'' as does paragraph (b) of the final rule. However, the scope of this requirement under the final rule is essentially the same as it would have been under the proposed rule. Under the proposed rule, all nonpermissible equipment, with the exception of a limited class of light-duty equipment and stationary unattended equipment, would have been subject to a whole machine approval under part 7. Because the final rule does not require whole machine approval of nonpermissible equipment, and instead requires that this equipment be provided with the safety features set forth in §§ 75.1909 and 75.1910, essentially the same features must be maintained and repaired by a qualified person under the final rule as would have been required under the proposal.

Paragraph (c) of the final rule requires that the water scrubber system on diesel-powered equipment be drained and flushed, by a person who is trained to perform this task, at least once during each shift that the equipment is operated. The proposed rule contained the same requirement for flushing scrubbers, but did not specify what type of training was required for the person performing the task.

The rationale behind the requirement for flushing and draining is that routine cleaning of scrubbers, which cool equipment exhaust gases and act as flame arresters, is essential to prevent a buildup of solid exhaust particles and sludge in the scrubber. This condition can eventually block internal passages of the scrubber, impairing the scrubber's effectiveness and compromising safety in the mine. The Advisory Committee also recommended that MSHA require mine operators to change scrubber water on a regular basis.

Commenters generally supported regular draining and flushing of

scrubber systems, although some commenters questioned whether the rule should specify the point in the shift when draining and flushing must be done. Commenters also questioned what level of qualification was necessary as a prerequisite to performing this task. The consensus of the Advisory Committee was that routine maintenance, such as changing scrubber water, could be performed by a person who is not certified, and that task training would be sufficient in those situations.

MSHA agrees that draining and flushing of the scrubber is a relatively straightforward task, and that the comprehensive training required for qualification under § 75.1915 is unnecessary to ensure that persons perform this task competently. The final rule therefore clarifies MSHA's intention that scrubber draining and flushing need not be done by a person qualified under § 75.1915, only that the person be trained to perform the task. MSHA expects that the draining and flushing of the water scrubber system will typically be performed by the machine operator.

In response to the proposed requirements for scrubber maintenance, some commenters stated that the final rule should specify that scrubber systems must be drained and flushed at the beginning of the shift. These commenters were concerned that if the rule did not specifically require draining and flushing at the beginning of the shift, MSHA could not issue a citation for violation of this standard until the end of the shift, making enforcement difficult. Other commenters advocated that the final rule require the scrubber system to be drained and flushed at the end of the shift, allowing mine operators to perform the task as part of the routine maintenance to prepare the machine for the next shift.

MSHA has carefully considered the comments on this issue, and has chosen to retain the language of the proposed rule in the final rule, which simply requires scrubber systems to be flushed and drained once during each shift that the equipment is operated, without specifying when during the shift the task must be performed. This is consistent with MSHA's intention to afford mine operators reasonable flexibility in performing the maintenance required by the final rule. However, MSHA recommends that mine operators perform scrubber maintenance at about the same point during every shift, thereby ensuring that scrubbers are flushed and drained every 8 to 10 hours (depending on the length of the shift) during the equipment's operation.

Paragraph (d) requires that the intake air filter be replaced or serviced either when the intake air pressure drop device indicates that it is necessary, or when the engine manufacturer's maximum allowable air pressure drop level is exceeded. The final rule also requires that this replacement or servicing be done by a person who is trained to perform the task.

Maintenance of diesel machine air filters is an important element of overall equipment maintenance. Air filters screen the air taken in by the machine for combustion. Over time, the filters load up with dust and dirt, restricting air flow and making the engine work harder to pull in the same amount of air. As the engine works harder, greater quantities of engine emissions are produced, adversely affecting the quality of the air that miners breathe. Research and experience indicate that air restrictions have a negative effect on emission generation, specifically carbon monoxide and diesel particulate.

The proposed rule would have required filter replacement or servicing when the filter was ''dirty'' as well as when the machine's intake air pressure drop device indicated that it was necessary. The proposed rule would not have required, as does the final rule, filter maintenance when the manufacturer's maximum allowable air pressure drop level is exceeded.

Commenters generally supported the requirements of this paragraph, and several stated that dirty air filters were frequently to blame when engines began to produce increased levels of carbon monoxide. However, several commenters objected to mandatory filter replacement and servicing when the filter was ''dirty'', pointing out that the term ''when dirty'' was ambiguous. Commenters stated that air filters catch dirt continually, and are therefore ''dirty'' to some degree at all times. MSHA agrees with commenters on this issue, and has concluded that the use of the term ''when dirty'' could create uncertainty for mine operators in complying with the provision. The requirement that filters be replaced or serviced ''when dirty'' has therefore not been adopted in the final rule.

The final rule does adopt the requirement of the proposed rule that air filters be replaced or serviced when the intake air pressure device indicates that it is necessary. Intake air pressure devices monitor the air pressure across the filter. As the air filter loads up with dust and dirt the pressure drop across the filter will increase, and at a certain point the intake air pressure device will signal that the filter is sufficiently blocked by dirt to require servicing or replacement.

Not all types of diesel-powered equipment are presently equipped with intake air pressure devices. Under the proposed rule, air filters without air pressure devices would have been required to be changed or serviced ''when dirty''. However, as discussed above, that provision has not been included in the final rule. One commenter to the proposed rule stated that service indicators specified by the manufacturer are sufficient for determining when an air filter should be changed. A service indicator is simply the manufacturer's specification of the drop in pressure across the air filter, reflected by the air pressure gauge on the machine, indicating that the air filter must be serviced or replaced. MSHA agrees that service indicators provide an objective and measurable method of determining the need for air filter servicing for machines without intake air pressure devices. The final rule has therefore been modified to provide that air filters must be replaced or serviced when the engine manufacturer's maximum allowable air pressure drop level is exceeded.

The proposal did not specify the level of training or qualification required for the person performing air filter maintenance under this paragraph, and commenters questioned whether MSHA intended that this task be performed by a person qualified under § 75.1915. Commenters generally stated that air filter maintenance did not need to be conducted by a qualified person, only by someone who has been trained to perform the task. This view is consistent with the consensus of the Advisory Committee that simple maintenance activities, such as changing air filters, could be performed by miners who are not qualified or certified. Accordingly, the final rule specifies that air filter maintenance must be performed by a person who has received training in the task.

Paragraph (e) requires that mobile diesel-powered equipment that is to be used during a shift be visually examined by the equipment operator before being placed in operation, and that equipment defects that affect safety be reported to the mine operator. This requirement is identical to that of the proposed rule, and was supported by commenters.

MSHA intends that the examinations required under this paragraph consist of the equipment operator conducting a check of the equipment before operating it to verify that the machine has no obvious safety defects, such as fuel leaks, loose batteries, or accumulations of combustible materials on the

machine. The language of the final rule has been changed slightly to require that the equipment be ''visually examined'' rather than ''inspected'', to better convey the nature of the examination. Such an examination will provide a regular check on some of the more conspicuous equipment problems. This paragraph also requires that observed defects be reported promptly to the mine operator, which could be a responsible management official, such as a superintendent or foreman. The word ''promptly'' has been included in the final rule to clarify that safety defects observed during this check should be directed to a responsible management official in a timely manner.

Paragraph (f) provides that all diesel-powered equipment must be examined and tested weekly by a person qualified under § 75.1915. Commenters generally agreed with the concept of mandatory equipment examination at regular intervals, although several commenters stated that only diesel equipment that was in use should be subject to required examinations, advocating revision of the rule to reflect that only equipment ''in service'' is subject to weekly examination.

Although MSHA understands the basis for these commenters' concerns, MSHA has concluded that inserting the term ''in service'' in the final rule could be misinterpreted by some mine operators to exclude equipment from the weekly examination requirement that the Agency does not intend to exclude. For example, some operators may consider equipment to be out of service if it has not been operated for an extended period, even though the equipment remains in the mine and could be operated at any time. MSHA takes a very broad view of what equipment is ''in service,'' regarding all equipment not located in maintenance shops or surface storage areas as being ''in service'' and subject to weekly examination and testing. MSHA has therefore not adopted the change advocated by commenters.

Although commenters supported the concept of regular examination and testing of diesel-powered equipment, there was no clear consensus on how regularly equipment must be examined. A few commenters who raised the issue of the frequency of required equipment examinations referred to maintenance schedules for diesel-powered equipment in place at their mines, with examination intervals of one week, two weeks, or every 150 hours of equipment operation. Other commenters stated that examination requirements for diesel-powered equipment should be similar to those for electrical equipment. The latter comment is consistent with the unanimous recommendation of the Advisory Committee that diesel-powered equipment be maintained on the same basis as electrical equipment.

MSHA has concluded that testing and examination of diesel-powered equipment on a weekly basis will ensure that equipment is being maintained in safe and healthful condition. Weekly examination of electrical equipment in underground coal mines has been required and has served as an effective check for adequate equipment maintenance for more than 20 years. Weekly examinations have consequently become an accepted element of routine equipment maintenance in the coal mining industry. Diesel equipment and electrical equipment in the underground coal mine environment present many of the same hazards. Paragraph (f) therefore provides for weekly testing and examination of diesel-powered equipment by a person qualified under § 75.1915.

Several commenters stated that the weekly examinations under paragraph (f) should be required only for approved components. Neither the proposed rule nor the final rule contains this limitation. The proposal would have specified that the weekly examinations be conducted in accordance with approved checklists, which are lists developed, with the assistance of MSHA, by an equipment manufacturer who is seeking MSHA approval. The proposal would have required fully assembled machine MSHA approval of all diesel-powered equipment, except for a ''limited class'' of light-duty nonpermissible equipment and stationary unattended equipment. The final rule requires full machine approval only for permissible equipment; nonpermissible equipment must only be provided with an approved engine. MSHA nonetheless believes that certain machine features, although not subject to MSHA approval, should be inspected as part of the regular examination.

Paragraph (f)(1) requires that examinations and tests be conducted in accordance with approved checklists and manufacturers' maintenance manuals. These checklists are to be used in conjunction with checklists and instructions included in manufacturers' maintenance manuals.

Commenters supported the use of checklists for examinations and tests of diesel-powered equipment. One commenter advocated that maintenance requirements be stated in general terms to accommodate new equipment design and improved technology in the future. MSHA agrees with this comment, and the use of equipment-specific permissibility/approval checklists and equipment manufacturers' maintenance manuals should achieve this result. MSHA would also consider a mine operator to be in compliance with this provision if the operator developed its own checklist format based on and consistent with the manufacturers' maintenance manuals.

Equipment manufacturers, with the assistance of MSHA, currently develop such checklists as part of the MSHA approval process. These checklists are designed to provide specific guidance to mine operators in verifying that approved equipment is in approved condition. Permissibility checklists are used to determine whether maintenance or repair is needed to bring the equipment back into approved condition; manufacturers' maintenance manuals complement these checklists by providing mine operators with specific instructions on how to conduct the necessary maintenance or repair. MSHA intends that the approved checklists referred to in this paragraph for diesel-powered equipment under part 7 will be similar to the permissibility checklists used for part 36-approved machines.

Commenters supported the use of checklists for examinations and tests of diesel-powered equipment. One commenter advocated that equipment maintenance requirements be stated in general terms to accommodate new equipment design and future technological improvements. MSHA believes that the use of equipment-specific permissibility/approval checklists should achieve this result, and has included language in the final rule that provides for the use of equipment-specific manufacturers' maintenance manuals in conjunction with the approved checklists in conducting necessary maintenance. MSHA would also consider a mine operator to be in compliance with this provision if operators developed their own checklist formats based on and consistent with the manufacturer's maintenance manuals.

Paragraph (f)(2) requires that persons performing weekly examinations and tests of diesel-powered equipment under this paragraph shall make a record when the equipment is not in approved or safe condition. The record must include the equipment that is not in approved or safe condition, the defect found, and the corrective action taken. This requirement has been adopted with modification from the proposed rule. Under the proposed rule, a record of all weekly equipment examinations would have been required, and recordkeeping

would not have been limited to those examinations that disclosed a defect. Under the final rule the recordkeeping burden has been reduced, consistent with efforts to reduce the paperwork burdens placed on the regulated public.

Commenters generally supported the concept of recording of examinations, and a number of commenters provided information on the type of records of equipment examination that were maintained at their mines. The record required by this paragraph may be entered or recorded by the qualified person who performed the examination, or by a responsible mine official, such as a foreman or superintendent.

Paragraph (g) requires the mine operator to develop and implement written standard operating procedures for weekly testing and evaluation of undiluted exhaust emissions from diesel-powered equipment used where permissible electrical equipment is required, and from heavy-duty diesel-powered equipment as defined in § 75.1908(a), in use underground. The paragraph also requires that specific aspects of the testing and evaluation process be addressed in the procedures. The final rule differs from the proposal in that the proposal would have required emission testing of all diesel-powered equipment underground, while the final rule narrows the requirement for such testing to permissible and heavy-duty nonpermissible equipment. The final rule also differs slightly from the proposal in the type of training required for the person who tests and evaluates the exhaust emissions.

The proposed emission testing requirements elicited the most controversy among commenters of all of the requirements in this section. Some commenters acknowledged that emission testing could be useful in monitoring the general operating condition of a diesel engine in identifying diesel equipment that needs maintenance. These commenters nonetheless expressed serious concern that a standardized in-mine test for undiluted exhaust emissions had not yet been devised, and until such a test was developed there would be no consistency in test results. These commenters recommended that emission test requirements not be included in the final rule. In response to these comments, the final rule limits required undiluted exhaust emission testing to permissible equipment and to heavy-duty nonpermissible equipment, as defined under § 75.1908(a). In-mine tests for diesel exhaust emissions have in fact been developed for these types of equipment. Permissible equipment and heavy-duty nonpermissible equipment are also typically the types of equipment that operate under load for extended periods of time, and consequently generate high levels of emissions relative to other types of equipment. Regular testing of the exhaust emissions of this equipment will help to ensure that this equipment is properly maintained.

A number of commenters supplied extensive information on emissions tests that had been developed and were being conducted at their mine, stating that such tests provided a valuable indication of engines that were in need of maintenance. Some commenters who supported the requirement for emissions testing in the proposed rule nonetheless recommended different testing intervals, ranging from two times per shift to once a month. One commenter stated that an emissions test frequency of one time per month was appropriate for light-duty equipment, while another commenter recommended that emissions be tested each week by a person qualified under § 75.1915, and during each shift by the equipment operator. The final rule adopts the proposed requirement for weekly exhaust emissions testing, consistent with the weekly examinations and testing requirement of paragraph (f). A weekly testing interval is of sufficient frequency to ensure that deteriorating engines are identified and serviced before they create a potential health hazard for miners in the area.

A number of commenters questioned where the exhaust gas should be sampled, some stating that they sampled diluted exhaust gas either in the equipment operator's compartment or at a significant distance from the tailpipe, such as 2 or 3 feet, and in one case 10 feet away. Several commenters stated that emissions test should be taken no more than 3 inches from the exhaust pipe if a particulate probe is not provided, because greater distances will not provide meaningful results. One commenter found that testing 2 feet away from the exhaust was very unreliable, and that the test results would depend on which way the machine was facing. Another commenter believed that test procedures used by some mine operators were intended to circumvent the goal of testing, which is to gauge engine performance and identify equipment that needs maintenance. Other commenters stated that while samples taken in the operator's compartment or away from the tailpipe can provide valuable information, inconsistent dilution prevents such samples from giving the most accurate indication of engine condition. One commenter's experience has shown that samples taken directly from the exhaust tailpipe provide a more accurate analysis of engine performance, and that samples drawn further away are influenced too much by the variables of mine ventilation. MSHA agrees with the commenters who are concerned about these variables, not least among them mine ventilation, that can dilute and distort emission samples that are taken any distance away from the machine tailpipe. A significantly diluted sample may fail to indicate declining engine performance and may not trigger the necessary corrective maintenance, thereby exposing miners to unhealthy levels of gaseous emissions. In response to these concerns, MSHA has concluded that adopting the requirement in the proposal for sampling of the undiluted exhaust emissions is the best way to ensure that the measurements will provide an accurate indication of deteriorating engine performance. The final rule specifically requires the testing of undiluted exhaust emissions, which means that emission samples required must be taken directly from the tailpipe, not at any distance away.

Paragraph (g) specifies that the person performing the weekly testing and evaluation of exhaust emissions be trained to perform the task. The person is not required to be qualified under § 75.1915, but does have to be adequately trained. This is a slight modification from the proposed rule, which would have required the person conducting emissions tests to demonstrate to a person qualified under § 75.1915 the capability to perform the tests. MSHA has concluded that the requirement in the proposed rule that the training be conducted by a qualified person is an unnecessary limitation. Mine operators have the responsibility of ensuring that persons who perform such tasks are adequately instructed in the activity. An important part of carrying out that responsibility is making sure that the persons conducting task training have the requisite knowledge and experience. Accordingly, the final rule simply requires that persons who test and evaluate emissions receive the necessary task training.

Paragraph (g)(1) requires that the emissions testing procedures developed by the mine operator include a method for achieving a repeatable loaded engine operating condition for each type of equipment, and is identical to what was proposed. Most commenters stated that a loaded engine test was not feasible for all types of equipment, specifically diesel machines equipped with clutches. Several commenters emphasized the difficulty of analyzing

the exhaust emissions of a loaded engine without exposing miners to the danger of sudden equipment movement. Other commenters stated that valid samples could not be obtained if the engine were not under load. In response to these commenters, and as discussed above, the final rule limits the requirement for exhaust testing to permissible equipment and heavy-duty nonpermissible equipment. These types of equipment are generally not equipped with clutched transmissions, and therefore do not present the problems identified by commenters that would exist with loaded engine tests for diesel equipment with clutches. As mentioned earlier, MSHA has developed loaded engine test procedures for the equipment subject to testing under the final rule.

Paragraph (g)(2) requires that the procedures for weekly testing and evaluation of the undiluted exhaust emissions of diesel engines specify sampling and analytical methods that include calibration of instrumentation capable of accurately detecting carbon monoxide in the expected concentrations. Commenters indicated that instruments are available and currently being used for accurate emissions testing. Several commenters stated that testing should not be limited to carbon monoxide, stating that they were currently testing for other gases, such as sulfur dioxide and the oxides of nitrogen. Other commenters were of the opinion that carbon monoxide concentrations were the best indicator of engine performance.

After consideration of all comments, MSHA has concluded that sampling for carbon monoxide alone is sufficient for determining a change in engine performance that may reflect a need for maintenance. Data indicates that carbon monoxide increases the most among the exhaust gases when an engine is poorly maintained, and is the best indicator that an engine needs attention. See, Report of the Bureau of Mines, U.S. Department of the Interior, ''Relationship of Underground Diesel Engine Maintenance to Emissions'' (December 1983). Sampling for nitrogen dioxide is required by § 70.1900 of the final rule. This will ensure that miners are not exposed to contaminants at levels above the applicable limits.

Paragraph (g)(3) requires that the procedures for emissions testing and evaluation include evaluation and interpretation of the emission test results. Commenters generally supported this requirement, and several commenters provided information on their evaluation and interpretation of results. This provision has been adopted unchanged from the proposed rule.

Paragraph (g)(4), like the proposal, requires that the testing procedures developed by the operator specify the concentration or changes in concentration of carbon monoxide that will indicate a change in engine performance. The paragraph also provides that concentrations of carbon monoxide shall not exceed 2500 parts per million, which is the limit for carbon monoxide established in the test procedures for Category B engines in subpart E of part 7 of the final rule. This aspect of the proposal received little comment, and has been adopted without change in the final rule.

Paragraph (g)(5) requires that the testing and evaluation procedures address the maintenance of records that are necessary to track engine performance. Commenters supported this requirement and indicated that some mines are already maintaining emissions records. The proposed rule would have required that the procedures address ''maintenance and retention of necessary records''. MSHA has added language to this paragraph to eliminate any ambiguity that might have been created by the term ''necessary records'', by specifying the purpose of the records required under this paragraph. MSHA has also eliminated the reference in the proposed rule to the ''retention'' of records, and has chosen instead to address retention of records in a new paragraph (h) in this section, discussed below.

Paragraphs (h)(1) and (h)(2) provide that records required by paragraphs (f)(2) and (g)(5) of this section must be recorded in a secure book that is not susceptible to alteration, or recorded electronically in a computer system that is secure and not susceptible to alteration. The records must be retained at a surface location for at least 1 year and made available for inspection by an authorized representative of the Secretary and by miners' representatives.

The proposed rule did not address the availability of or access to records under this section. One commenter recommended that records of weekly examination be accessible to miners' representatives. MSHA agrees with this comment, and has revised the paragraph to provide miners' representatives with access to records. The final rule also requires such access for authorized representatives of the Secretary, to allow MSHA inspectors to review records to verify that examinations and tests required under this section have been conducted.

The final rule does not specify a particular way of making records, only that they are to be recorded in a manner that is not susceptible to alteration. A detailed discussion on the issue of recordkeeping and electronic records can be found under ''Recordkeeping Requirements'' in the General Discussion section of this preamble.

The proposed rule would have required that the emission testing procedures under paragraph (g) include the designation of training of the individual who performs the tests. This requirement has not been adopted in the final rule. Instead, as discussed earlier, the rule imposes a performance-based requirement that emissions testing and evaluation under this paragraph be conducted by a person who has been trained to perform the task. Mine operators are consequently responsible for ensuring that individuals who test and evaluate emissions receive the training necessary to ensure their competence. The ability of these persons to discharge their responsibilities is of much greater concern to MSHA than the training they receive to achieve it, and the final rule reflects this emphasis.

Finally, several commenters recommended that this section include a requirement for regular examination of fire suppression systems. Examination of fire suppression systems is not addressed here, but instead is dealt with in § 75.1911 of the final rule, which provides that equipment fire suppression systems be visually inspected at least once each week, and be tested and maintained in accordance with the manufacturer's recommended inspection and maintenance program.

Paragraph (i) provides that diesel-powered equipment must be maintained in accordance with this part beginning 12 months after the date of publication of the final rule. This time is allowed for the development of a training and qualification program under § 75.1915 and for the training of individuals who perform work on diesel-powered equipment. MSHA recognizes that the resources available for training in particular geographical areas may be limited in some cases, and that competent trainers may be in significant demand as mine operators prepare to comply with the requirements of the final rule. A one-year delayed effective date for the requirements of this section should afford the mining community sufficient time to prepare for compliance.

Section 75.1915 Training And Qualification Of Persons Working On Diesel-Powered Equipment

This section of the final rule requires a training and qualification program for persons who perform maintenance, repairs, examinations and tests on diesel-powered equipment, as required by § 75.1914. These critical tasks must be performed correctly for diesel equipment to be maintained in safe condition with acceptable levels of emissions. The final rule sets minimum, performance-based requirements for training and qualification programs, and requires successful completion of such a program for a person to be qualified to perform diesel maintenance, repairs, examinations, and tests.

The final rule differs from the proposed rule in several respects: it does not require the training and qualification programs to be approved by MSHA; it does not specify an interval for retraining; it clarifies that the rule does not require MSHA approval of instructors who provide training; and it eliminates the use of the term ''diesel mechanic''.

Paragraph (a) of this section of the final rule provides that in order to be qualified to perform maintenance, repairs, examinations, and tests on diesel-powered equipment, as required by § 75.1914, a person must complete a training and qualification program which meets the requirements of the section. A qualified person is required to be retrained when necessary to maintain the ability to perform all assigned maintenance, repairs, examinations, and tests. The final rule does not require, as would have the proposed rule, that MSHA approve training and qualification programs developed under this section.

Although there was virtually universal agreement among commenters that some form of training was essential for persons working on diesel equipment, commenters disagreed about the need for a formal training and qualification program and the necessity of MSHA review and approval of such programs. Some commenters were of the opinion that persons working on diesel equipment should be formally qualified, and that diesel training programs for qualification should meet strict minimum standards and be subject to approval by MSHA. One commenter stated that if strict training requirements were not included in the standard, the necessary training would not be provided.

Other commenters opposed requiring a formal program with specific requirements, advocating as an alternative performance-oriented standards that could be adapted to a mine's specific needs. One commenter stated that a formal qualification scheme was unnecessary, and that diesel maintenance training should be provided on an as-needed basis in the same manner as task training under part 48. Another commenter maintained that the benefits realized from a formal qualification program would not justify the additional administrative burdens of such a program. The Office of Management and Budget guidance comments directed MSHA to reexamine whether all of the information proposed to be submitted to MSHA for approval of training and qualification programs had practical utility and imposed the least burden on mine operators.

Numerous other commenters, while supporting the establishment of procedures to qualify persons to perform work on diesel equipment, were opposed to the proposed requirement that MSHA approve training and qualification programs. Many commenters indicated that very good diesel equipment maintenance training is already being provided by mine operators as well as equipment manufacturers, without MSHA review or approval. In contrast, other commenters maintained that training programs should meet the approval of all interested parties, including MSHA and the representative of miners, to ensure that the training is adequate. The Diesel Advisory Committee had unanimously recommended that MSHA require persons performing work on approved diesel equipment features be trained and tested for competency, and that the training and testing be approved by MSHA.

After careful consideration of all of these views and comments, MSHA has concluded that a basic structure for training and qualification programs for persons performing certain work on diesel equipment is necessary. Properly trained persons are fundamental to adequate maintenance of diesel-powered equipment. To meet this objective, MSHA believes minimum criteria for the training and qualification of these persons are essential. Paragraph (a) therefore provides that to be qualified to perform diesel equipment maintenance, repairs, examinations, and tests, as required by § 75.1914, a person must successfully complete a training and qualification program meeting the requirements of the section.

The proposal that MSHA review and approve training and qualification programs is not adopted in the final rule. MSHA's paper review of training and qualification programs, as proposed, could provide an initial check of the quality of the program. Such a review would not, however, ensure that the program is successful in its implementation. Rather than expending Agency resources on the review and approval of diesel training programs, MSHA will direct those resources toward verification of the effectiveness of training and qualification programs in their execution. Similarly, mine operators and training providers can focus on the development and administration of their training and qualification programs rather than on procedures to gain MSHA approval. The rulemaking record contains a number of well-designed diesel training plans already in effect, demonstrating that the mining community has the expertise needed to develop and implement effective training programs. MSHA will closely monitor the effectiveness of the training programs implemented under this section.

Paragraph (a) also requires retraining when needed. The proposed rule would have required qualified persons to undergo retraining every 12 months. Some commenters to the proposed rule opposed the establishment of a specific requirement for annual retraining, stating that the mining industry needed performance-oriented standards that could be adapted to mine-specific needs for maintenance and training. Other commenters stated that an annual retraining requirement was necessary to ensure that persons working on diesel-powered equipment maintained the necessary knowledge and expertise over time.

MSHA considers retraining to be an important part of any training program. The final rule, however, does not mandate retraining at specified intervals. MSHA has concluded that mine operators should tailor the frequency of retraining to the conditions and practices at each mine, to ensure that all persons who work on diesel-powered equipment maintain the requisite level of expertise. Factors that could affect the timing of retraining include the frequency with which the qualified person works on specific pieces of diesel equipment; newly developed techniques for performing the required inspections and tests; and any modifications that may have been made to the equipment since the last training. Frequent retraining may be necessary at some mines to ensure that qualified persons retain sufficient skill and knowledge to perform their jobs effectively. At other mines where conditions are less changeable, retraining at greater intervals may be appropriate.

Paragraph (a) of the final rule also eliminates the term ''diesel mechanic'', was used in the proposal to identify those persons qualified to perform maintenance and repairs of approved features of diesel equipment. Many commenters to the proposed rule objected to the use of the term, stating that it would result in the creation of a new job title or classification. MSHA did not intend to establish a new job classification through the use of the term ''diesel mechanic'', and concludes from the comments that its use would result in confusion. The term ''diesel mechanic'' has therefore not been adopted in the final rule.

Finally, the phrase ''examinations and tests'' has been included in paragraph (a) of the final rule, reflecting that a person qualified under this section would be authorized to conduct weekly examinations and tests of diesel-powered equipment under § 75.1914(f), in addition to maintenance and repairs of such equipment under § 75.1914(b).

Paragraph (b) provides a basic structure for training and qualification programs, but is intended at the same time to provide mine operators with sufficient latitude in developing their programs. MSHA believes that training and qualification programs will be most effective if they are tailored to specific mining conditions and equipment in use at the mine, as well as to the skill levels and experience of the persons being trained.

A number of commenters reported that they already have training and qualification programs in place at their mines, and provided descriptions and documentation of these programs. Many of these programs utilize training at off-site facilities, such as community colleges and technical and trade schools. Commenters also indicated that mining equipment manufacturers are typically called upon to provide training. These programs generally include classroom training modules as well as hands-on in-mine training on specific pieces of equipment. Commenters stated that the duration of training programs could be from three days to eight weeks. The length of the program was generally dependent upon how much diesel-powered equipment was used at the mine, as well as on the previous experience and skill level of the persons being trained.

MSHA anticipates that local community colleges and technical schools will assist mine operators in developing the training and qualification programs required under this section. Commenters indicated that this type of assistance is already being provided to mine operators in a number of areas of the country.

Paragraph (b)(1) requires that training courses be presented by a competent instructor, in contrast to the proposed rule, which would have required that courses for training and retraining be conducted by either a qualified diesel mechanic or ''other instructor determined by MSHA to be qualified.'' Several commenters objected to this aspect of the proposal, based on their belief that the proposal required some type of formal approval by MSHA before anyone other than a qualified person could conduct diesel training under this section. A number of other commenters believed that such approval would only add an unnecessary procedural hurdle to providing training. Contrary to the understanding of such commenters, MSHA did not intend by the proposal to approve training instructors. The language of the final rule has been clarified to provide that courses may be presented by a competent instructor. A competent instructor under paragraph (b)(1) could be a person qualified under § 75.1915, an instructor from a trade school or college, or a person experienced in diesel maintenance, such as a representative of an equipment or engine manufacturer, or even the chief of maintenance at the mine, provided that the instructor has the necessary technical expertise.

Paragraph (b)(2) of the final rule provides that the training and qualification program must be sufficient to prepare or update a person's ability to perform all assigned tasks with respect to diesel-powered equipment maintenance, repairs, examinations, and tests. This paragraph incorporates the requirements of proposed paragraphs (e)(2) and (e)(3), except that it substitutes the term ''person'' for the term ''diesel mechanic,'' for the reasons stated in the discussion of paragraph (a) of this section. Several commenters were opposed to the requirement in proposed paragraph (e)(3) that courses in the training program address each piece of diesel-powered equipment in use at the mine, stating that this could be an unnecessary burden at mines that operate a variety of types of diesel-powered equipment. These commenters stated that if an individual never worked on certain pieces of equipment, requiring that individual to receive training on all equipment in use at the mine would be unnecessary.

MSHA did not intend proposed paragraph (e)(3) to require that each qualified person be trained on all types of diesel-powered equipment in use in the mine, only those pieces of diesel-powered equipment the qualified person actually works on. However, the language of proposed paragraph (e)(3) could be interpreted to require that the courses in the training program cover all pieces of diesel equipment in use at the mine.

MSHA agrees with the commenters that training should be tailored to the duties and responsibilities of the individual qualified person. The language in the final rule has therefore been clarified to reflect this concept. A qualified person is not required to be trained on a particular type of equipment, unless he or she performs work on it. However, a person who is untrained on a particular type of equipment is not a qualified person with respect to that equipment, and may not perform maintenance, repairs, and tests required to be conducted by a qualified person. Finally, MSHA anticipates that training will address equipment by model and not by individual machine, unless machines at the mine with the same model number differ because of field changes or other special features. In such cases training would need to take into account any significant differences among machines.

While MSHA's intent is to promote flexibility in the implementation of training and qualification programs, the final rule does specify minimum topics of instruction for these programs. Paragraphs (b)(3)(i) through (b)(3)(vii) of the final rule set forth the specific areas of instruction that must be covered by a training and qualification program. Commenters were generally in agreement with the areas of instruction required under the proposed rule, and the language of the final rule is virtually the same as what was proposed''.

Paragraph (b)(3)(i) requires that training programs address the ''requirements of subpart T of this part''. Several commenters recommended that the phrase ''as applicable'' be added to this requirement, to eliminate the need for training to address requirements that may not be directly applicable at the specific mine. This recommendation is not adopted in the final rule. MSHA believes that a person qualified under this section should have, at a minimum, basic familiarity with the scope of subpart T and the diesel-powered equipment safety standards. However, MSHA does not intend that this aspect of the final rule require exhaustive coverage of requirements that have no application to the mine in question. The well-designed, mine-specific training program contemplated by this section will focus on the requirements that are the most relevant. For example, if a mine does not store diesel fuel underground, qualified persons working

at that mine would not be expected to have extensive knowledge of the requirements of the standards governing fuel storage. Qualified persons should nonetheless be aware that subpart T contains provisions that address underground fuel storage.

Paragraph (b)(3)(ii) is virtually identical to proposed paragraph (e)(4)(ii), and requires that the training program address the use of power package or machine checklists to conduct tests to ensure that diesel equipment is in approved and safe condition, with acceptable emission levels. Some commenters reported that maintenance of the permissibility features of approved equipment was often neglected, and emphasized the importance of using only trained personnel to evaluate these features. This requirement is intended to ensure that training addresses the evaluation of the equipment's permissibility features. Several commenters also questioned the meaning of the term ''safe operating condition''. The term has been changed to ''safe condition'' to conform to the terminology in § 75.1914. MSHA intends that ''safe condition'' used in this paragraph means that the equipment has been maintained in compliance with subpart T of this part and does not present a hazard to miners. Finally, the language of this paragraph has been slightly revised to delete the term ''appropriate'' from the phrase ''to conduct appropriate tests'', because it is unnecessary and redundant.

Paragraph (b)(3)(iii) of this section is identical to proposed paragraph (e)(4)(iii), and requires that the training program cover the proper maintenance of approved features and the correct use of appropriate maintenance manuals, including machine adjustments, service, and assembly. Paragraph (b)(3)(iii) is different from paragraph (b)(3)(ii) in that it addresses proper maintenance of equipment, while paragraph (b)(3)(ii) addresses tests to ensure permissibility.

Paragraph (b)(3)(iv) of the final rule requires that training under this section address tests and maintenance of fire suppression system on diesel-powered equipment. The final rule uses the phrase ''fire suppression system'' rather than ''fire protection system,'' which was used in the proposed rule, to conform the language of the final rule to terminology that is more commonly in use. The purpose of this requirement is to ensure that a qualified person has sufficient familiarity with the elements of fire suppression systems used on diesel equipment.

Paragraph (b)(3)(v) of this section requires that fire and ignition sources and their control and elimination, including cleaning the equipment, be addressed by the training program. The phrase ''including cleaning of the equipment'' has been added in response to comments emphasizing the importance of frequent cleaning of equipment to prevent the accumulation of combustible materials such as oil, grease and float coal dust and thereby reduce the risk of fire. This requirement is consistent with and is intended to reinforce compliance with § 75.400, which has been revised in this final rule to specifically prohibit accumulations of combustible material on diesel-powered equipment.

Paragraph (b)(3)(vi) of this section requires that the training program address safe fueling procedures and maintenance of the equipment's fuel system. The importance of proper refueling procedures is illustrated by the analysis of the Canadian fire accident data in the discussion of § 75.1908. These data show that the failure to follow proper refueling procedures resulted in several fires.

Paragraph (b)(3)(vii), like the proposal, requires that the training program address maintenance and testing of the engine's intake air system. A number of commenters reported that failure to replace dirty intake air filters was the most frequent cause of excessive levels of smoke and carbon monoxide from otherwise properly adjusted engines.

Proposed paragraph (e)(4)(viii) would have required the training course to address tests and maintenance of the engine shutdown device. Because engine shutdown devices are in fact components of permissible equipment, training covering these devices will already be required by paragraphs (b)(3)(ii) and (iii) of this section, discussed above. The language of proposed paragraph (e)(4)(viii) has therefore not been included in the final rule.

Proposed paragraph (e)(4)(ix) would have given the district manager the authority to require the training program to cover additional subjects necessary to address specific health and safety needs. This provision has not been adopted in the final rule, which is designed to be more performance-oriented. As discussed above, the requirements of this section are intended to result in the development of training programs that are tailored to the specific needs of each mine, including the equipment being used and the skill levels of the persons receiving the training. Failure to address mine-specific health and safety needs in the training program may result in MSHA determining that a mine operator is not in compliance with § 75.1915. Additionally, the proposed rule would have required MSHA approval of training programs and would have provided a framework for the exercise of district manager authority under proposed paragraph (e)(4)(ix). As discussed above, the final rule does not require MSHA approval of training programs. For these reasons, this proposed provision has not been adopted in the final rule.

Paragraph (b)(4) requires the training and qualification program to include an examination that requires demonstration of the ability to perform all assigned tasks with respect to diesel equipment maintenance, repairs, examinations, and tests. There is no specific requirement that the examination be in writing, although an examination that effectively assesses competence will most likely include a written test as well as a practical portion that allows a hands-on evaluation of a person's abilities. Under the proposed rule, a minimum score of 80 percent would have been required on any written portion of a qualification examination. Although some commenters supported the concept, MSHA has concluded that mandating a minimum score is unnecessary when a written portion is not a required part of the examination. Further, such a specific requirement is at odds with the performance-oriented approach of this paragraph. The requirement for a minimum score has therefore been omitted from the final rule.

Paragraph (b)(5) requires that the training and qualification program be in writing, and contain a description of the course content, materials, and teaching methods to be used for initial training and retraining. The language of this paragraph is substantially the same as proposed paragraph (d)(1), except that the word ''approved'' has been omitted. As discussed above, the program will not be subject to MSHA approval under the final rule.

The requirements of proposed paragraphs (d)(2) and (d)(3) have not been adopted in the final rule. Specifically, proposed paragraph (d)(2) would have required that the training and qualification program include a copy of the examination, to allow MSHA to review the examination as part of the approval process. Because the final rule does not require MSHA approval, and also because a written examination is not required, a copy of the examination does not need to be included as part of the program.

Proposed paragraph (d)(3) would have required that the program include a description of the evaluation program to be used for retraining to assess the knowledge, skills, and ability of the

qualified person. This requirement has not been included in the final rule, consistent with MSHA's intention to measure the effectiveness of training and qualification programs by how well diesel-powered equipment is being maintained at the mine, rather than by the adequacy of a written program. Consequently, the final rule does not require a retraining evaluation program, but MSHA expects that mine operators will closely monitor the maintenance of diesel equipment at their mines, and will ensure that qualified persons receive the necessary retraining.

Paragraph (c) of this section requires the mine operator to maintain a copy of the training and qualification program required by this section and a record of the names of all persons qualified under the program. Paragraph (c)(1) requires that the record of the names of qualified persons be made in a manner that is not susceptible to alteration or recorded electronically in a computer system that is secure and not susceptible to alteration. Under paragraph (c)(2), the training and qualification program and the record of qualified persons must be kept at a surface location of the mine and made available for inspection by an authorized representative of the Secretary and by miners' representatives. Paragraph (c) incorporates, with certain revisions, the requirements originally proposed in §§ 75.1916 (i) and (j). Proposed §§ 75.1916 (i) and (j) would have required a list of current instructors also to be included in the training and qualification program and, in addition to the names of all qualified persons, the dates of qualification and the date of the last retraining. MSHA has removed these additional recordkeeping requirements from the final rule, consistent with the Agency's intention to gauge the adequacy of training and retraining by how effectively diesel-powered equipment at the mine is maintained. The final rule does not specify a particular method for maintaining the record of qualified persons, only that it is not susceptible to alteration. A detailed discussion of recordkeeping and electronic records can be found under the heading ''Recordkeeping Requirements'' in the General Discussion section of this preamble.

Finally, the proposed rule specified procedures in § 75.1916 for MSHA's administration of training and qualification programs. Among other things, the proposed rule set forth a process for MSHA review and approval of the training and qualification program required under § 75.1915, and established procedures for the revocation of individual qualifications. Because MSHA will not be formally reviewing and approving training and qualification programs, procedural requirements for review and approval are unnecessary. Consequently, the provisions proposed in § 75.1916 have not been retained in the final rule, with the exception of the requirements of proposed §§ 75.1916(i) and (j), as discussed above.

Section 75.1916 Operation Of Diesel-Powered Equipment

Section 75.1916 addresses speed limits and other traffic restriction on roadways in underground coal mines where diesel-powered equipment is operated. This section also prohibits unnecessary idling of diesel-powered equipment, as well as the operation of unattended diesel-powered equipment.

The Diesel Advisory Committee advocated MSHA regulation of operating conditions of diesel-powered equipment, recommending proposal of a rule that addressed speed limits, road conditions, and operator control of vehicles. This section is intended to ensure that diesel-powered equipment underground is operated in a safe manner, and requires that operating speeds of diesel-powered equipment be consistent with conditions in the mine, and that operators of diesel-powered equipment maintain full control of the equipment when it is in motion. Standardized traffic rules, including speed, signals, and warning signs, are required to be established at each mine and followed.

The final rule recognizes that the safe operating speed for a particular piece of diesel-powered equipment depends greatly on the specific mining conditions and the type of equipment being operated, and as a result the final rule does not establish a universal speed limit for diesel-powered equipment operated in underground coal mines. Finally, idling of mobile diesel-powered equipment is prohibited, except as required in normal mining operations. Operation of unattended diesel-powered equipment is also prohibited under this section.

Several commenters recommended elimination of the requirements of this section, stating that the proposed standards were too vague and could result in inconsistent enforcement. Some of these commenters suggested reducing the proposed requirements of this section to a single requirement that the mine operator establish traffic rules, appropriate for the specific mine conditions at each mine, that address speed and operator control of equipment. A number of commenters also pointed out that existing § 75.1403 gives MSHA the authority to regulate hazards arising from the transportation of men and materials at underground coal mines. These commenters believed that transportation hazards were already adequately covered under § 75.1403, and that additional regulation was therefore unnecessary.

The existing authority to issue safeguards under § 75.1403 does not make the requirements of this section unnecessary. Section 75.1403 authorizes an MSHA inspector to issue a ''safeguard notice'' when the inspector determines that a transportation hazard exists at a mine and the hazard is not already addressed by a mandatory standard. The ''safeguard notice'', issued by an MSHA inspector to the mine operator, identifies the nature of the hazard and establishes requirements based on the actual conditions or practices that constitute a transportation hazard at the particular mine. After the mine operator is given a reasonable time to come into compliance with the requirements set forth in the safeguard notice, the safeguard has the force and effect of a mandatory standard at the mine and can be enforced as such. Sections 75.1403–1 through 75.1403–11 contain criteria to guide inspectors in issuing safeguards, covering a wide range of potential transportation hazards, such as clearance distances on belt conveyors and track haulage roads, brakes on hoists and elevators, and safety gates for entrances to shafts and slopes.

Safeguards are not a substitute for the mandatory requirements in § 75.1916. Although some of the topics covered in this section, such as speed limits and roadway conditions, are included as safeguard criteria in §§ 75.1403–1 through 75.1403–11, the criteria are not enforceable unless and until they have been incorporated in a safeguard notice, after an MSHA inspector has determined that a hazard exists. In contrast, the requirements of this section of the final rule apply at all underground coal mines where diesel-powered equipment is used. In addition, safeguard criteria are intended to be tailored to the unique conditions and practices at an individual mine, while the requirements in this section are general in nature, although mine operators are given the flexibility to set traffic rules appropriate for the conditions at their mines. The final rule therefore does not reflect the opinion of some commenters that the requirements under this section are unnecessary.

The requirements of this section specifically govern the manner and conditions under which diesel-powered

equipment operates in underground coal mines, and recognize that diesel-powered equipment tends to be much larger and more powerful, and to have the ability to travel at much greater speeds than electric-powered equipment. Some types of diesel-powered equipment used in underground coal mines, such as pickup trucks, are designed for use on highways, and can travel at speeds in excess of 60 miles per hour (mph). In comparison, a typical piece of mobile rubber-tired battery-powered equipment will have a top speed of less than 10 mph. The potential traffic hazards are therefore significantly greater in the operation of diesel-powered equipment, and there is a resulting need for the minimum requirements set by the final rule at mines where diesel-powered equipment is operated.

Paragraph (a) of this section adopts the requirements of the proposal and provides that operating speeds of diesel-powered equipment must be consistent with the type of equipment being operated, the conditions of roadways, grades, clearances, visibility, and other traffic. Under this paragraph diesel-powered equipment must be operated at all times at safe speeds, which in many cases will be slower than the maximum speed limit set in the mine-wide traffic rules established under paragraph (c).

Some commenters recommended that the rule specify a maximum speed limit, such as 15 mph or 25 mph, that would apply at all underground coal mines. These commenters stated that a standardized speed limit would promote compliance because the rules would be the same at all mines everywhere. A few of these commenters recommended that equipment be fitted with gear reduction ratios that would make it mechanically impossible for equipment to be operated at speeds above the limit. Other commenters opposed the establishment of a universal speed limit for all mines, stating that safe speeds were highly dependent on variable mining conditions, and that a speed that is prudent under one set of circumstances could be quite unsafe, even reckless, under another.

The requirements of this paragraph recognize that certain mine conditions and equipment characteristics must be taken into account in determining the speed at which equipment can be safely operated. Mine conditions have been a contributing factor in many traffic accidents. Adverse conditions that can negatively impact equipment safety include steep grades and slippery mine surfaces, which decrease the effectiveness of equipment brakes. Particularly large diesel-powered machines, which can take up nearly an entire mine entry, can present significant limitations in visibility for the equipment operator, whose line of vision is below the machine frame. Consequently, the equipment operator has several large blind spots where other pieces of equipment and mine personnel cannot be seen. Large haulage units operating in the same area as small pieces of diesel-powered equipment can create particularly dangerous traffic patterns. The proposed rule would have required roadways to be kept as free as practicable from bottom irregularities or other conditions that could affect control of the equipment. A number of commenters recommended elimination of this paragraph, noting that the proposed rule would require standardized traffic rules and could be used to address concerns about roadway conditions. Other commenters supported this proposed requirement, citing the dangers that can result from poorly maintained roads.

Although MSHA agrees that keeping mine roads free from bottom irregularities, debris, and wet or muddy conditions is important to safe operation of diesel-powered equipment, the requirements of paragraphs (a), (b), and (c) of this section of the final rule are sufficient to address concerns about adverse road conditions. The requirements of proposed paragraph (a), which would have required roadway maintenance, have therefore not been adopted in the final rule.

Under the requirements of the final rule, vehicle speed must take into account roadway conditions and other factors that affect safe equipment operation. Equipment operators are required to maintain full control of their equipment, and traffic rules must be established and followed at each mine where diesel-powered equipment is operated.

Paragraph (b) also adopts the requirements of the proposal and provides that equipment operators must maintain control of mobile diesel-powered equipment while it is in motion. Commenters generally supported this requirement, which recognizes that there may be cases where the roadway conditions, posted operating speed, and traffic rules are adequate but other factors interfere with the equipment operator's ability to exercise full control over the equipment. For example, the rule would prohibit the operator from carrying tools or supplies in the operator's compartment that interfere with the operator's ability to control the equipment. Additionally, equipment controls must be free of any debris which could obstruct safe operation. Operator inattention could also constitute a violation of this requirement if the inattention causes unsafe operation of the equipment.

Paragraph (c) requires that standardized traffic rules, including speed limits, signals, and warning signs, be established and followed at each mine. Under this provision, the mine operator must develop mine-wide traffic rules to address hazards arising from the operation of diesel-powered equipment, and ensure that mine employees are aware of the rules and comply with them. This is consistent with the suggestions of several commenters, who supported simplifying the proposed rule requirements by a single provision that mine operators establish safe operating rules appropriate for mine conditions. The requirements in the final rule are similar to those of the proposal, except that the final rule provides that traffic rules must be ''followed'', and does not adopt the proposed requirement that the rules be ''posted.'' Mine operators have the responsibility to take whatever steps are necessary to ensure that their employees are familiar with the mine's traffic rules and follow them. Although posting of traffic rules can serve as a means for mine operators to facilitate compliance, it is not specifically required under the final rule.

Commenters who advocated a standardized maximum speed limit at all underground coal mines, in response to proposed paragraph (b), renewed this recommendation in their comments to this paragraph. For the reasons discussed above, the final rule does not impose a universal speed limit. Some commenters suggested that simply requiring the establishment of a mine-wide speed limit would eliminate the need for other traffic rules. MSHA disagrees that restrictions on speed alone will eliminate potential traffic hazards. The traffic rules required under this paragraph are intended to address other factors that affect safe operation of diesel-powered equipment, such as changes in mining conditions.

Some commenters recommended that MSHA provide criteria for mine operators to use in establishing mine traffic rules, and that operators develop traffic plans, consistent with these criteria, that are reviewed and approved by MSHA. The final rule does not adopt this recommendation. Although MSHA's review of a mine's traffic rules could provide a preliminary check on the adequacy of the rules, such a review will not ensure that they have been effectively implemented. The final rule reflects MSHA's conclusion that both mine operator and Agency resources are

better spent ensuring that traffic rules are being followed. However, if an MSHA inspector determines that an operator's traffic rules fail to adequately address the mine's traffic hazards, MSHA will require revision of the traffic rules.

This paragraph also requires that the traffic rules be followed. The language in the proposed rule did not specifically require that the rules be ''followed,'' although MSHA believes that most commenters understood that the rules must be obeyed. To eliminate any possible ambiguity or misunderstanding, the rule has been clarified to specifically require that the rules be complied with.

One commenter recommended that mine operators be required to investigate and file reports of mine traffic accidents in specific circumstances, such as where an injury occurs or where a certain amount of damage is sustained. MSHA regulations at part 50 already require mine operators to investigate and report certain accidents to MSHA, as well as to report to MSHA all occupational injuries and illnesses. MSHA has concluded that there is no compelling reason why traffic accidents and injuries should be treated differently from other types of mining accidents and injuries. The final rule therefore does not adopt this comment.

Paragraph (d) prohibits idling of mobile diesel-powered equipment, except as required in normal mining operations. This prohibition has been added to the final rule in response to the concerns of some commenters, who observed that engines are excessively idled most frequently in areas where it is impractical to increase air quantities. This results in high levels of exhaust contaminants in these areas of the mine, and increases the risks of miner overexposure. The final rule addresses this problem by prohibiting unnecessary engine idling. The intent of this provision is that equipment parked at any location, including the loading point, will be shut down if it is not being used to do work.

Paragraph (e) has been added to the final rule and prohibits the operation of unattended diesel-powered equipment. The proposal would have prohibited portable limited class equipment from being operated unattended. This prohibition is consistent with the decision not to adopt the proposed requirements for stationary unattended equipment into the final rule, and is explained in detail in the preamble discussion of stationary unattended equipment.

Amendment of Certain Part 75 Standards

MSHA's part 75 sets forth mandatory safety standards for each underground coal mine. The final rule amends existing §§ 75.342, 75.400, 75.1710 and 75.1710–1 to extend their application to diesel-powered equipment, requiring the installation of methane monitors on certain types of diesel-powered equipment, prohibiting accumulation of combustible materials on diesel-powered equipment in active workings of underground coal mines, and requiring diesel-powered face equipment and shuttle cars to be equipped with substantially constructed cabs or canopies. Although these existing standards specifically apply to electric equipment, the hazards that these standards are designed to address are independent of the power source of the equipment.

The requirements of these four mandatory safety standards have applied to electric-powered equipment for a number of years, and have been extremely effective in protecting miners from the hazards of fires, explosions, and roof falls. The Diesel Advisory Committee recommended that MSHA review its existing standards to determine whether any existing safety requirements should be made applicable to diesel-powered equipment.

In the preamble to the proposed rule, MSHA solicited comments on extending the applicability of certain listed standards to diesel-powered equipment. The standards listed in the proposal included § 75.313 (now § 75.342, methane monitors); § 75.400 (accumulation of combustible materials); § 75.400–2 (cleanup programs); §§ 75.523, 75.523–1, and 75.523–2 (emergency deenergization of self-propelled equipment); § 75.1107–1 (fire suppression devices); and §§ 75.1710 and 75.1710–1 (cabs and canopies on face equipment). MSHA also solicited comments on whether any other part 75 standards that were not listed should be made applicable to diesel-powered equipment.

Commenters expressed general support for extending requirements for methane monitors, brakes, and cabs and canopies to diesel-powered equipment. Some commenters expressed the view that all equipment safety features on diesel-powered equipment should be addressed under part 75. One commenter suggested that all requirements in part 75, particularly §§ 75.500 through 75.524 (applicable to battery- and electric-powered equipment), be applied to diesel-powered equipment. Other commenters stated that all necessary equipment safety features should be required as part of the equipment approval process, rather than as standards under part 75.

The final rule retains MSHA's longstanding approach of including in part 75 general equipment safety requirements such as methane monitors, prohibitions against accumulation of combustible materials, and cabs and canopies. The approach of requiring general safety features in part 75 has been effective in protecting miners in underground coal mines where electric-powered equipment is in use. As discussed below, the safety hazards addressed by the standards amended in the final rule are the same regardless of the equipment's power source.

By including these equipment safety requirements in part 75, mine operators will have the flexibility to improve safety by making machine modifications based on specific conditions at each mine. For example, the selection of an appropriate cab or canopy for a machine is dependent on mine height and entry width.

Section 75.342 Methane Monitors.

Methane monitors automatically shut down permissible electric mining equipment used to extract or load coal when methane concentrations around the equipment reach 2.0 percent. Permissible diesel equipment can create the same explosion hazard as permissible electric equipment if operated in the presence of high concentrations of methane. Also, under certain conditions, a diesel engine can ingest methane from the mine atmosphere, resulting in uncontrolled acceleration of the diesel engine during start up or operation, and produce an ignition of methane in the area.

Methane monitors are recognized as a critical link in the safety protections designed to prevent mine explosions. These monitors are normally mounted on equipment that operates in the face area, providing the first warning that methane gas is accumulating in potentially dangerous quantities.

The final rule requires methane monitors on all diesel-powered face cutting machines, continuous miners, longwall face equipment, loading machines, and other diesel-powered equipment used to extract or load coal in the working place. By applying the methane monitor requirements of existing § 75.342 to diesel-powered equipment, miners working around such equipment will be protected from fire and explosion hazards to the same degree as miners working in areas where similar electric-powered equipment is in use.

Section 75.400 Accumulation of Combustible Materials

The final rule requires that coal dust, loose coal, and other combustible materials be cleaned up and not permitted to accumulate in active workings or on electric equipment therein. The hazards of a mine fire or explosion in an underground coal mine are similar for diesel-powered and electric-powered equipment. Coal dust can produce a ready fuel source when combined with the lubricating and hydraulic oils used in diesel-powered equipment and can start a fire if it comes into contact with ignition sources on the equipment. As discussed elsewhere, diesel-powered equipment that is not equipped with surface temperature controls, such as outby equipment, may have engine and exhaust surfaces above the ignition temperature of coal dust. Accumulations of coal dust can also contribute to the propagation and severity of mine fires and explosions. Because diesel equipment uses large quantities of diesel fuel and hydraulic fluid, once a fire starts it can quickly spread due to the close availability of these fuel sources on a diesel machine. A large fire can then ensue and spread in the mine. By adding the term ''diesel-powered'' to § 75.400, MSHA intends that the longstanding prohibition against the accumulation of combustible materials will now be explicitly applied to diesel-powered equipment.

Sections 75.1710 and 75.1710–1—Cabs and Canopies.

The final rule amends § 75.1710 to require diesel-powered face equipment and shuttle cars to be equipped with substantially constructed cabs or canopies to protect miners operating such equipment from roof falls and rib and face rolls. The final rule also applies the installation requirements for cabs and canopies in § 75.1710–1 to diesel-powered equipment.

Cabs and canopies provide very effective protection to equipment operators from the hazards of roof and rib falls and in collisions with the mine roof and ribs. Since 1972, approximately 250 miner fatalities have been prevented by cabs and canopies installed on electric equipment. Some mine operators have recognized the clear safety benefits of cabs and canopies and have installed these devices on the diesel-powered self-propelled face equipment in their mines. By specifically extending the existing requirements in these sections to diesel-powered self-propelled face equipment, including shuttle cars, the operators of all such equipment will be afforded the same protection that is currently provided for operators of electric equipment.

Several standards identified in the proposal as possible subjects for revision have not been amended in this final rule. Section 75.400–2, which requires the establishment of a cleanup program for the removal of accumulations prohibited under § 75.400, has not been specifically amended to include the term ''diesel-powered equipment.'' Existing § 75.400–2 does not make reference to a particular type of equipment, either diesel- or electric-powered. The standard simply requires that a program be established for the cleanup and removal of combustible materials. Therefore, § 75.400–2 already applies to diesel-powered equipment and amending the standard is unnecessary.

MSHA also solicited comments in the proposed rule on whether the requirements of §§ 75.523, 75.523–1 and 75.523–2 should be applied to diesel-powered equipment. These standards protect equipment operators from pinning and crushing injuries by requiring self-propelled electric face equipment to be equipped with panic bars, which quickly deenergize the tramming motors in the event of an emergency. The existing standards do not require panic bars if the equipment is provided with a substantially constructed cab or canopy in accordance with § 75.1710–1, or if other devices approved by MSHA are installed to quickly deenergize the tramming motor in the event of an emergency.

Because §§ 75.523, 75.523–1, and 75.523–2 make specific reference to the interrelationship among electric motors, electrical control components, cabs, emergency parking brakes, and panic bars, these standards cannot be readily adapted to diesel-powered equipment. An MSHA study of diesel-powered face equipment accidents occurring from 1984 to 1995 found that this type of equipment is manufactured with a substantially constructed operator's compartment which provides the same protection as a cab. The study also found no pinning or crushing accidents of the type that would have been prevented by a panic bar on diesel equipment. Since this type of diesel equipment will be evaluated under part 36, the approval process can ensure that the protection features provided on diesel equipment will provide at least the same protection as that provided by a panic bar on electrical equipment. The final rule, therefore, does not amend § 75.523 to require panic bars or the equivalent on diesel-powered equipment.

The proposed rule also solicited comment on the applicability of existing § 75.1107–1, which requires fire suppression devices on certain attended and unattended underground electric equipment, to diesel-powered equipment. The fire hazards presented by diesel-powered equipment are different from those on electric-powered equipment, due to the close proximity of large quantities of hydraulic oils and fuels to the heated diesel engine exhaust. Because effective fire suppression systems are essential for the safe operation of diesel-powered equipment, specific requirements for fire suppression systems on diesel-powered equipment are addressed in the final rule at § 75.1911.

Derivation Table

The following table lists final standard section numbers and corresponding section numbers of existing standards from which they are derived.

| New sections | Existing sections |
|---|---|
| Part 7—Subpart E ..... | New, Parts 7, 32, 36 |
| 7.81 ..... | New |
| 7.82 ..... | New, 36.2, 7.2 |
| 7.83 ..... | New, 36.6, 7.3 |
| 7.84 ..... | New, 32.4(f), 36.26(b), 36.44, 75.322 |
| 7.85 through 7.87 ..... | New |
| 7.88 ..... | New, 75.322 |
| 7.89 ..... | New |
| 7.90 ..... | New, 36.11 |
| 7.91 and 7.92 ..... | New |
| Part 7—Subpart F ..... | New, Parts 7, 18, 36 |
| 7.95 ..... | New |
| 7.96 ..... | New, 36.2, 7.2 |
| 7.97 ..... | New, 36.6, 7.3 |
| 7.98 ..... | New, Part 36—Subpart B |
| 7.99 ..... | New |
| 7.100 and 7.101 ..... | New, 36.46 |
| 7.102 and 7.103 ..... | New, 36.47 |
| 7.104 ..... | New, 36.46 |
| 7.105 ..... | New, 7.6, 36.11 |
| 7.106 ..... | New, 7.8(b) |
| 7.107 ..... | New, 7.52 |
| 7.108 and 7.109 ..... | New |
| Part 36 ..... | Partly new, Part 31 |
| 36.1 ..... | Partly new |
| 36.2(e) ..... | Partly new |
| 36.2(f) ..... | Partly new, 36.2(h) |
| 36.6 (b)(2) through (b)(4). | Partly new |
| 36.9(a) ..... | Partly new |
| 36.20(b) ..... | Partly new |
| 36.20(c) ..... | New |
| 36.21 ..... | Partly new |
| 36.43(a) ..... | Partly new |
| 36.48(b) ..... | Partly new |
| 70.1900(a) ..... | New, 75.100, 75.362 |
| 70.1900 (a)(1) through (b)(3). | New |
| 70.1900(c) ..... | New, 75.322, 75.325(j) |

| New sections | Existing sections |
|---|---|
| 70.1900(d) | New, 75.363 |
| 70.1900 (d)(1) through (e). | New |
| 75.325 (f) through (h) | New, Part 32 |
| 75.325 (i) and (j) | New, Part 32, 75.322 |
| 75.325(k) | New, Part 32, 75.371 |
| 75.342 (b)(2) and (c) | Partly new |
| 75.360(b)(7) | Partly new |
| 75.371(r) | Partly new |
| 75.371 (kk) through (oo). | New |
| 75.371(pp) | New, 75.322 |
| 75.400 | Partly new |
| 75.1710 and 75.1710–1. | Partly new |
| Part 75—Subpart T | New, Part 32 |
| 75.1900 | New, 75.301 |
| 75.1901(a) | New, 36.2(i) |
| 75.1901(b) | New |
| 75.1901(c) | New, 40 CFR 79 |
| 75.1902 | New |
| 75.1903(a)(1) | New, 75.301, 75.340 |
| 75.1903 (a)(2) and (a)(3). | New |
| 75.1903(a)(4) | New, 75.333(e), 75.340 |
| 75.1903 (a)(5) through (a)(7). | New |
| 75.1903(b)(1) | New, 75.1100–2(f) |
| 75.1903 (b)(2) through (d)(6). | New |
| 75.1904 | New |
| 75.1905 | New |
| 75.1906 (a) through (f). | New |
| 75.1906(g) | New, 75.1107–3 through 75.1107–6, 75.1107–8 through 75.1107–16 |
| 75.1906 (h) and (i) | New |
| 75.1906(j) | New, 75.1000–3 |
| 75.1906 (k) and (l) | New |
| 75.1907 | New |
| 75.1908 | New |
| 75.1909 (a)(1) through (a)(3)(i). | New |
| 75.1909 (a)(3)(ii) | New, 36.27(a)(1) |
| 75.1909 (a)(3)(iii) through (a)(3)(ix). | New |
| 75.1909 (a)(3)(x) | New, 36.27(c) |
| 75.1909 (a)(3)(xi) through (b)(3). | New |
| 75.1909(b)(4) | New, 36.28 |
| 75.1909(b)(5) | New, 36.33(b) |
| 75.1909 (b)(6) through (b)(8). | New, 36.29 |
| 75.1909(c) | New, 75.523–3, 75.1404, 75.1404–1 |
| 75.1909(c)(1) | New, 75.523–3(b)(2) |
| 75.1909(c)(2) | New, 75.523–3(b)(3) |
| 75.1909(c)(3) | New, 75.523–3(b)(4) |
| 75.1909(c)(4) | New, 75.523–3(b)(5) |
| 75.1909(c)(5) | New, 75.523–3(c) |
| 75.1909(c)(6) | New |
| 75.1909(d) | New, 75.523–3(d) |
| 75.1909(e) | New, 75.523–3(e) |
| 75.1909(f) | New, 36.29 |
| 75.1909 (g) through (j). | New |
| 75.1910(a) | New, 75.518, 75.518–1 |
| 75.1910 (b) through (e). | New |
| 75.1910(f) | New, 75.513, 75.513–1 |
| 75.1910 (g) and (h) | New, 75.515 |
| 75.1910(i) | New, 75.514 |
| 75.1910(j) | New |
| 75.1910(k) | New, 7.44(a)(1) |
| 75.1910(l) | New, 7.44 (d), (e), and (m) |
| 75.1910(m) | New, 7.44(f) |
| 75.1910(n) | New, 7.44(h) |
| 75.1910(o) | New, 7.44(g) |
| 75.1911 (a) through (k). | New |
| 75.1911(l) | New, 75.380(f), 75.1107–3 through 75.1107–16 |
| 75.1912(a)(1) | New, 75.1107–13 |
| 75.1912 (a)(2) through (b). | New |
| 75.1912(c) | New, 75.1101–23 |
| 75.1912(d) | New, 75.1107–4 |
| 75.1912 (e) through (g). | New |
| 75.1912(h) | New, 75.1107–16 |
| 75.1912(i) | New |
| 75.1912(j) | New, 75.1101–23 |
| 75.1913 | New |
| 75.1914 | New |
| 75.1915 | New |
| 75.1916(a) | New, 75.380(d), 75.1403 |
| 75.1916 (b) through (e). | New |

*Distribution Table*

The following table lists section numbers of existing standards which contain provisions that were used in the development of the listed final standards.

| Existing sections | New sections |
|---|---|
| 7.2 | 7.82, 7.96 |
| 7.3 | 7.83, 7.97 |
| 7.6 | 7.105 |
| 7.8(b) | 7.106 |
| 7.44(a)(1) | 75.1910(k) |
| 7.44 (d) and (e) | 75.1910(l) |
| 7.44(f) | 75.1910(m) |
| 7.44(g) | 75.1910(o) |
| 7.44(h) | 75.1910(n) |
| 7.44(m) | 75.1910(l) |
| 7.44(a)(1) | 75.1910(k) |
| 7.52 | 7.107 |
| Part 31 | Part 36 |
| Part 32 | Part 7—Subpart E, 75.325 (f) through (k), and Part 75—Subpart T |
| 32.4(f) | 7.84 |
| Part 36—Subpart B | 7.98 |
| 36.2 | 7.82, 7.96 |
| 36.2(h) | 36.2(f) |
| 36.2(i) | 75.1901(a) |
| 36.6 | 7.83, 7.97 |
| 36.11 | 7.90, 7.105 |
| 36.26(b) | 7.84 |
| 36.27(a)(1) | 75.1909(a)(3)(ii) |
| 36.27(c) | 75.1909(a)(3)(x) |
| 36.28 | 75.1909(b)(4) |
| 36.29 | 75.1909 (b)(6) through (b)(8) and (f) |
| 36.33(b) | 75.1909(b)(5) |
| 36.44 | 7.84 |
| 36.46 | 7.100, 7.101, 7.104 |
| 36.47 | 7.102, 7.103 |
| 75.100 | 70.1900(a) |
| 75.301 | 75.1900, 75.1903(a)(1) |
| 75.322 | 7.84, 7.88, 70.1900(c), 75.325 (i) and (j), 75.371(pp) |
| 75.325 (g) and (i) | 75.371(r) |
| 75.325(j) | 70.1900(c) |
| 75.333(e) | 75.1903(a)(4) |
| 75.340 | 75.1903 (a)(1) and (a)(4) |
| 75.362 | 70.1900(a) |
| 75.363 | 70.1900(d) |
| 75.371 | 75.325(k) |
| 75.380(d) | 75.1916(a) |
| 75.380(f) | 75.1911(l) |
| 75.513 and 75.513–1 | 75.1910(f) |
| 75.514 | 75.1910(i) |
| 75.515 | 75.1910 (g) and (h) |
| 75.518 and 75.518–1 | 75.1910(a) |
| 75.523–3 | 75.1909(c) |
| 75.523–3(b)(2) | 75.1909(c)(1) |
| 75.523–3(b)(3) | 75.1909(c)(2) |
| 75.523–3(b)(4) | 75.1909(c)(3) |
| 75.523–3(b)(5) | 75.1909(c)(4) |
| 75.523–3(c) | 75.1909(c)(5) |
| 75.523–3(d) | 75.1909(d) |
| 75.523–3(e) | 75.1909(e) |
| 75.1000–3 | 75.1906(j) |
| 75.1100–2(f) | 75.1903(b)(1) |
| 75.1101–23 | 75.1912 (c) and (j) |
| 75.1107–3 through 75.1107–16. | 75.1911(l) |
| 75.1107–3 through 75.1107–6 and 75.1107–8 through 75.1107–16. | 75.1906(g) |
| 75.1107–4 | 75.1912(d) |
| 75.1107–13 | 75.1912(a)(1) |
| 75.1107–16 | 75.1912(h) |
| 75.1403 | 75.1916(a) |
| 75.1404 and 75.1404–1. | 75.1909(c) |
| 40 CFR 79 | 75.1901(c) |

## III. Paperwork Reduction Act

The information collection requirements contained in this rule have been submitted to the Office of Management and Budget (OMB) for review under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501–3520), as implemented by OMB in regulations at 5 CFR 1320. No person may be required to respond to, or may be subjected to a penalty for failure to comply with, these information collection requirements until they have been approved by OMB and MSHA has displayed the assigned OMB control number. The OMB control number, when assigned, will be announced by separate notice in the Federal Register.

The final rule addresses comments submitted to OMB and MSHA on the collection of information requirements in the proposed rule in the section-by-section discussions. In revising the requirements from those that appeared in the proposed rule, MSHA has evaluated the necessity and usefulness of the collection of information; reevaluated MSHA's estimate of the information collection burden, including the validity of the underlying methodology and assumptions; and minimized the information collection burden on respondents to the extent possible. This final rule also provides for the use of electronic storage and maintenance of records.

Tables 1 through 4 show the distribution of information collection burden hours imposed by the requirements of the final rule. Tables 1 and 2 pertain to manufacturers, Table 3 pertains to small mine operators, and Table 4 pertains to large mine operators.

TABLE 1.—ESTIMATED ANNUAL NEW BURDEN RELATED TO MANUFACTURERS

| Detail | Number of respondents | Hours per response | Number of responses | Number of responses per respondent | Capital costs annualized (rounded) | Operating and maintenance costs (rounded) | Total hours |
|---|---|---|---|---|---|---|---|
| Part 7—Subpart E | | | | | | | |
| New Eng. (Perm.)[1] | 1.5 | 43 | 1.5 | 1 | $0 | $0 | 65 |
| New Eng. (Perm.)[2] | 1.5 | 0.5 | 1.5 | 1 | 0 | 75 | 1 |
| New Eng. (Nonperm.)[3] | 2.5 | 34 | 2.5 | 1 | 0 | 0 | 85 |
| New Eng. (Nonperm.)[4] | 2.5 | 0.5 | 2.5 | 1 | 0 | 100 | 1 |
| Existing Eng. (Nonperm.)[5] | 16 | 5 | 16 | 1 | 425 | 0 | 80 |
| New Eng. (Nonperm.)[6] | 1 | 34.5 | 1 | 1 | 0 | 2,600 | 35 |
| Existing Eng. (Nonperm.)[7] | 1 | 34.5 | 1 | 1 | 200 | 0 | 35 |
| 7.90 | 148 | 0.1667 | 148 | 1 | 0 | 450 | 24 |
| Part 7—Subpart F | | | | | | | |
| New Pow. Pack. (Perm.)[8] | 1.5 | 43 | 1.5 | 1 | 0 | 0 | 65 |
| Existing Pow. Pack. (Perm.)[9] | 33 | 12 | 33 | 1 | 2,100 | 0 | 396 |
| 7.105 | 20 | 0.1667 | 20 | 1 | 0 | 75 | 3 |
| Total Increases | | | | | 2,725 | 3,300 | 790 |

[1] New diesel-powered engine models used in permissible equipment will require a maximum fuel:air ratio test and a gaseous ventilation rate test under part 7, subpart E, instead of under existing part 36. Burden hours are shifted from existing part 36 to part 7, subpart E. The annual estimated application costs of $4,850 are currently being incurred by manufacturers under part 36. Under the final rule, such costs will continue to be incurred under part 7, subpart E, instead of under part 36. There are no new compliance costs.

[2] New diesel-powered engine models used in permissible equipment that would have received part 36 approval will require a particulate index test.

[3] New diesel-powered engine models used in nonpermissible equipment that would have received part 32 approval will require a maximum fuel air ratio test and a gaseous ventilation rate test under part 7, subpart E, instead of under part 32. As a result of this rule, part 32 is deleted and burden hours related to the tests on such engine models are shifted from deleted part 32 to part 7, subpart E. The annual estimated application costs of $6,375 are currently being incurred by manufacturers under part 32. Under the final rule, such costs will continue to be incurred under part 7, subpart E, instead of under part 32. There are no new compliance costs.

[4] New diesel-powered engine models used in nonpermissible equipment that would have received part 32 approval will require a particulate index test.

[5] Existing diesel-powered engine models used in nonpermissible equipment that have part 32 approval will require a one time particulate index test.

[6] New diesel-powered engine models used in nonpermissible equipment that would not have received part 32 approval will require a maximum fuel air ratio test, a gaseous ventilation rate test, and a particulate index test.

[7] Existing diesel-powered engine models used in nonpermissible equipment that do not have part 32 approval will require a one time maximum fuel air ratio test, a gaseous ventilation rate test, and a particulate index test.

[8] New diesel-power package models used in permissible equipment will require approval under part 7, subpart F, instead of under part 36. Burden hours related to such approvals are shifted from part 36 to part 7, subpart F. The annual estimated application costs of $4,850 are currently being incurred by manufacturers under part 36. Under the final rule, such costs will continue to be incurred under part 7, subpart F, instead of under part 36. There are no new compliance costs.

[9] Diesel-power package models used in permissible equipment and previously approved under part 36 could be reapproved and used to comply with the requirement for a diesel power package pursuant to part 7, subpart F.

TABLE 2.—ESTIMATED ANNUAL DECREASE IN BURDEN RELATED TO MANUFACTURERS[1]

| Detail | Number of respondents | Hours per response | Number of responses | Number of responses per respondent | Capital costs annualized | Operation and maintenance costs | Total hours |
|---|---|---|---|---|---|---|---|
| Part 36 | | | | | | | |
| New Eng. (Perm.)[2] | 1.5 | 43 | 1.5 | 1 | $0 | $0 | 65 |
| New Pow. Pack. (Perm.)[3] | 1.5 | 43 | 1.5 | 1 | 0 | 0 | 65 |
| Part 32 | | | | | | | |
| New Eng. (Nonperm.)[4] | 2.95 | 34.5 | 2.95 | 1 | 0 | 0 | 102 |
| Total Decreases | | | | | | | 232 |

[1] Burden hours in this chart were developed and approved under the Paperwork Reduction Act of 1980 (PRA 80). PRA 80 did not require costs to be reported with burden hours. Thus no compliance costs are noted in this table.

[2] New diesel-powered engine models used in permissible equipment will be approved under part 7, subpart E, instead of part 36.

[3] Diesel-power package models used in permissible equipment will be approved under part 7, subpart F, instead of part 36.

[4] New diesel-powered engine models used in nonpermissible equipment will be approved under part 7, subpart E, instead of part 32.

TABLE 3.— ESTIMATED ANNUAL NEW BURDEN FOR SMALL UNDERGROUND COAL OPERATORS THAT USE DIESEL-POWERED EQUIPMENT [1]

| Detail | Number of respondents [2] | Hours per response | Number of responses | Number of responses per respondent | Capital costs annualized (rounded) | Operation and maintenance costs (rounded) | Total hours |
|---|---|---|---|---|---|---|---|
| § 75.363 | 10 | 0.10 | 100 | 10 | $2,100 | $3,800 | 10 |
| § 75.370 | 15 | 0.1667 | 15 | 1 | 0 | 100 | 3 |
| § 75.1901(a) | 8 | 0.05 | 160 | 20 | 0 | 100 | 8 |
| § 75.1904(b)(4)(i) | 15 | 0.0333 | 20 | 1 | <25 | 0 | 1 |
| § 75.1911 (i)&(j) [3] | 15 | 0.3333 | 212 | 14 | 0 | 1,835 | 71 |
| § 75.1911 (i)&(j) [4] | 15 | 1.0833 | 11 | <1 | 0 | 915 | 12 |
| § 75.1912 (h)&(i) [5] | 15 | 0.5833 | 20 | 1 | 0 | 300 | 12 |
| § 75.1912 (h)&(i) [6] | 15 | 1.0833 | 2 | <1 | 0 | 100 | 2 |
| § 75.1914 (f)(1)&(h) | 15 | [7] 1.1857 | 500 | 33 | 0 | 15,400 | 593 |
| § 75.1914 (f)(2)&(h) | 15 | 0.0833 | 500 | 33 | 0 | 1,100 | 42 |
| § 75.1914(g)&(h) [8] | 15 | 2 | 30 | 2 | 150 | 0 | 60 |
| § 75.1914 (g)&(h) [9] | 1 | 2 | 1 | 1 | 0 | 50 | 2 |
| § 75.1914 (g)(5)&(h) | 15 | 0.25 | 1,480 | 98 | 3,150 | 16,650 | 370 |
| § 75.1915(a) | 15 | 5 | 30 | 2 | 400 | 0 | 150 |
| § 75.1915 (b)(5)&(c) [8] | 15 | 10 | 15 | 1 | 400 | 0 | 150 |
| § 75.1915 (b)(5)&(c) [9] | 1 | 3 | 1 | 1 | 0 | 125 | 3 |
| Total | | | | | 6,225 | 40,475 | 1,489 |

[1] Small mines are those that employ 19 or fewer people.
[2] Respondents are the number of small mines.
[3] Section 75.1911(j) requires a record of § 75.1911(i) weekly exams which find defects.
[4] Section 75.1911(j) requires a record of § 75.1911(i) manufacturer recommended exams which find defects.
[5] Section 75.1912(i) requires a record of § 75.1912(h) weekly exams which find defects.
[6] Section 75.1912(i) requires a record of § 75.1912(h) manufacturer recommended exams which find defects.
[7] Represents a weighted average of hours based upon different exam hours for different types of equipment.
[8] Reflects burden hours that will occur in the first year of implementation of the provision.
[9] Reflects burden hours that will occur annually, after the first year of implementation of the provision.

TABLE 4.—ESTIMATED ANNUAL NEW BURDEN FOR LARGE UNDERGROUND COAL OPERATORS THAT USE DIESEL-POWERED EQUIPMENT [1]

| Detail | Number of respondent [2] | Hours per responses | Number of responses | Number of responses per respondent | Capital costs annualized (rounded) | Operating and maintenance costs (rounded) | Total hours |
|---|---|---|---|---|---|---|---|
| § 75.363 | 100 | 0.1834 | 1,000 | 10 | $20,950 | $40,825 | 184 |
| § 75.370 | 158 | 0.3333 | 158 | 1 | 0 | 1,975 | 52 |
| § 75.1901(a) | 79 | 0.05 | 1,975 | 25 | 0 | 1,000 | 99 |
| § 75.1904(b)(4)(i) | 158 | 0.0333 | 494 | 3 | 250 | 0 | 16 |
| § 75.1911 (i) & (j) [3] | 158 | 0.3333 | 14,810 | 94 | 0 | 128,340 | 4,936 |
| § 75.1911 (i) & (j) [4] | 158 | 1.0833 | 592 | 4 | 0 | 51,335 | 641 |
| § 75.1912 (h) & (i) [5] | 158 | 0.5833 | 100 | <1 | 0 | 1,525 | 58 |
| § 75.1912 (h) & (i) [6] | 158 | 1.0833 | 4 | <1 | 0 | 350 | 5 |
| § 75.1914 (f)(1) & (h) | 158 | [7] 0.6234 | 35,975 | 227 | 0 | 583,150 | 22,428 |
| § 75.1914 (f)(2) & (h) | 158 | 0.0833 | 35,975 | 227 | 0 | 77,925 | 2,997 |
| § 75.1914 (g) & (h) [8] | 158 | 2 | 711 | 4 | 3,725 | 0 | 1,422 |
| § 75.1914 (g) & (h) [9] | 5 | 2 | 22.5 | 4 | 0 | 1,700 | 45 |
| § 75.1914 (g)(5) & (h) | 158 | 0.25 | 52,350 | 331 | 33,100 | 460,225 | 13,088 |
| § 75.1915(a) | 158 | 5 | 1,264 | 8 | 0 | 236,000 | 6,320 |
| § 75.1915 (b)(5) & (c) [8] | 158 | 16 | 158 | 1 | 6,600 | 0 | 2,528 |
| § 75.1915 (b)(5) & (c) [9] | 5 | 16 | 5 | 1 | 0 | 3,000 | 80 |
| Total | | | | | 64,625 | 1,587,350 | 54,899 |

[1] Large mines are those that employ 20 or more people.
[2] Respondents are the number of large mines.
[3] Section 75.1911(j) requires a record of § 75.1911(i) weekly exams which find defects.
[4] Section 75.1911(j) requires a record of § 75.1911(i) manufacturer recommended exams which find defects.
[5] Section 75.1912(i) requires a record of § 75. 1912(h) weekly exams which find defects.
[6] Section 75.1912(i) requires a record of § 75. 1912(h) manufacturer recommended exams which find defects.
[7] Represents a weighted average of hours based upon different exam hours for different types of equipment.
[8] Reflects burden hours that will occur in the first year of implementation of the provision.
[9] Reflects burden hours that will occur annually, after the first year of implementation of the provision.

## IV. Executive Order 12866 and Regulatory Flexibility Analysis

Under E.O. 12866 [58 FR 51735, October 4, 1993] the Agency must determine whether the regulatory action is ''significant'' and subject to OMB review.

E.O. 12866 defines ''significant regulatory action'' as one that is likely to result in a rule that may: (1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the right and obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

OMB determined that this rule for diesel-powered equipment in underground coal mines is a ''significant regulatory action'' because MSHA's diesel particulate rulemaking for all mines has been designated ''significant'' by the Agency. Although the diesel particulate rulemaking is separate and distinct from this final rule, OMB concluded that there is a sufficient enough relationship with this final rule to warrant its designation as significant. As such, MSHA has submitted this final rule to OMB for review.

As required by E.O. 12866, the Agency determined costs and benefits associated with this final rule and has prepared a Final Regulatory Impact Analysis (RIA) and a Final Regulatory Flexibility Analysis (RFA). The RFA assesses benefits and costs of, and potentially effective and reasonably feasible alternatives to, the planned regulatory action. The RIA and RFA are available electronically and on request from MSHA through the address listed in the contact section at the beginning of this document. It is summarized below.

### *Benefits*

The final rule establishes comprehensive and integrated requirements governing diesel-powered equipment used in underground coal mines. Compliance with the rule will minimize fire, explosion, fuel handling, and fuel storage hazards. The health hazards of diesel engine exhaust are addressed by design, performance, and maintenance standards for diesel engines. Other safety hazards associated with the use of diesel-powered equipment in underground coal mines are also addressed.

The final rule includes tests and specifications for MSHA approval of diesel engines. Clean operating engines will reduce miners' exposure to harmful emissions in the confined underground mine environment. The final rule sets test procedures and limits on the concentrations of carbon monoxide and oxides of nitrogen, and establishes the quantity of ventilating air necessary to dilute these exhaust contaminants to safe levels. The rule also contains tests and specifications for approval of diesel engine components, to ensure that diesel engines are fire and explosion-proof.

The final rule also requires diesel-powered equipment to be equipped with certain safety features. These safety features will result in reduced fire hazards and lower the risk of accidents involving diesel-powered equipment. For example, the final rule requires diesel-powered equipment to have basic safety features, such as brakes and lights; fire protection features, including fuel, hydraulic, and electrical system protections; and properly designed, installed, and maintained fire suppression systems. In addition, the rule extends to diesel-powered equipment safety measures that already apply to electric-powered equipment that are proven to protect miners from cave-ins, such as cabs and canopies, and from explosions, such as methane monitors.

The final rule provides for a systematic approach to the clean and safe operation of diesel-powered equipment. To accomplish this, the final rule sets standards for ventilation of diesel-powered equipment, and for routine sampling of toxic exhaust gases in the workplace, and requires the use of low sulfur diesel fuel to minimize emissions. It also requires that maintenance be performed by trained personnel to keep diesel equipment in proper operating condition.

To ensure that the hazards associated with diesel fuel usage in the underground mine environment are properly controlled, the final rule includes requirements for the underground storage, transportation, and dispensing of diesel fuel. Design, tank capacity, and dispensing requirements are set for diesel fuel storage, as well as safety precautions and construction requirements for underground storage facilities and areas, including automatic fire suppression systems. These provisions will reduce the risk of fires involving diesel fuel.

The final rule also extends several longstanding safety requirements for electric equipment to diesel-powered equipment. The final rule requires certain diesel equipment to be installed with methane monitors, providing miners with critical protection against methane explosions. The final rule also requires cabs and canopies to be installed on certain diesel-powered equipment, protecting miners from the dangers of roof and rib falls in the underground mine environment.

### *Cost of Compliance*

The compliance costs associated with the standards directly impact two industry groups: manufacturers of diesel-powered mining equipment and operators of underground coal mines. Part 7, subparts E and F relate to manufacturer costs and parts 70 and 75 relate to operator costs. The total compliance costs of the rule are estimated to be about $10.35 million per year, of which mine operators will incur about $10.3 million per year and manufacturers will incur about $50,000 per year.

The per-year cost of $10.3 million for mine operators consists of $4.9 million of annualized cost plus $5.4 million of annual costs. Of the $10.3 million, large mine operators will incur about $10.1 million, which consists of $4.8 million of annualized costs and $5.3 million of annual costs. Of the $10.3 million, small mine operators will incur about $210,800, which consists of $92,300 of annualized costs and $118,500 of annual costs. The per-year compliance costs for large and small mine operators is shown by section in Table 5.

Manufacturers will incur costs of approximately $50,450 per year. The $50,450 consists of $15,900 of annualized costs and $34,550 of annual costs. The per-year compliance costs for manufacturers is shown by section in Table 6.

TABLE 5.—UNDERGROUND COAL MINE COMPLIANCE COSTS FOR DIESEL EQUIPMENT

[Dollars × 1,000]

| Standard | Large and small mines | | | Large mines | | | Small mines | | |
|---|---|---|---|---|---|---|---|---|---|
| | (A) total [col. B+C] | (B) annualized | (C) annual | (D) total [col. E+F] | (E) annualized | (F) annual | (G) total [Col. H+I] | (H) annualized | (I) annual |
| 70.1900 | ($59.7) | $80.9 | ($140.6) | ($77.7) | $75.8 | ($153.5) | $18.0 | $5.1 | $12.9 |
| 75.325 | 589.0 | 0 | 589.0 | 589.0 | 0 | 589.0 | 0 | 0 | 0 |
| 75.1902 | 39.7 | 39.7 | 0 | 37.6 | 37.6 | 0 | 2.1 | 2.1 | 0 |
| 75.1903 | 68.5 | 51.5 | 17.0 | 58.2 | 44.7 | 13.5 | 10.3 | 6.8 | 3.5 |
| 75.1904 | 32.7 | 32.7 | 0 | 31.2 | 31.2 | 0 | 1.5 | 1.5 | 0 |
| 75.1905 | 2.4 | 2.4 | 0 | 2.3 | 2.3 | 0 | 0.1 | 0.1 | 0 |
| 75.1906 | 251.8 | 173.5 | 78.3 | 244.7 | 168.8 | 75.9 | 7.1 | 4.7 | 2.4 |
| 75.1907 | 1,610.3 | 1,596.6 | 13.7 | 1,589.6 | 1,576.4 | 13.2 | 20.7 | 20.2 | 0.5 |
| 75.1909 | 3,028.0 | 2,532.9 | 495.1 | 2,971.2 | 2,487.6 | 483.6 | 56.8 | 45.3 | 11.5 |
| 75.1910 | 117.4 | 117.4 | 0 | 116.1 | 116.1 | 0 | 1.3 | 1.3 | 0 |
| 75.1911 | 1,221.3 | 0 | 1,221.3 | 1,203.2 | 0 | 1,203.2 | 18.1 | 0 | 18.1 |
| 75.1912 | 20.0 | 0 | 20.0 | 16.5 | 0 | 16.5 | 3.5 | 0 | 3.5 |
| 75.1913 | 9.5 | 9.5 | 0 | 9.4 | 9.4 | 0 | 0.1 | 0.1 | 0 |
| 75.1914 | 2,769.3 | 40.1 | 2,729.2 | 2,700.0 | 36.8 | 2,663.2 | 69.3 | 3.3 | 66.0 |
| 75.1915 | 573.9 | 155.4 | 418.5 | 572.3 | 153.9 | 418.4 | 1.6 | 1.5 | 0.1 |
| 75.1916 | 8.7 | 8.7 | 0 | 8.4 | 8.4 | 0 | 0.3 | 0.3 | 0 |
| Total | 10,282.8 | 4,841.3 | 5,441.5 | 10,072.0 | 4,749.0 | 5,323.0 | 210.8 | 92.3 | 118.5 |

TABLE 6.—ESTIMATED MANUFACTURERS COMPLIANCE COSTS ASSOCIATED WITH THE REGULATIONS FOR DIESEL-POWERED EQUIPMENT IN UNDERGROUND COAL MINES

| Standard | Manufacturers costs | | |
|---|---|---|---|
| | (A) total [col. B+C] | (B) annualized | (c) annual |
| Part 7—Subpart E | $42,650 | $12,200 | $30,450 |
| Part 7—Subpart F | 7,800 | 3,700 | 4,100 |
| Total Part 7 | 50,450 | 15,900 | 34,550 |

*Regulatory Flexibility Certification*

The Regulatory Flexibility Act requires that agencies developing regulatory standards evaluate and, where possible, include compliance alternatives that minimize any impact that would adversely affect small businesses. The use of diesel-powered equipment presents similar health and safety hazards in both large and small mining operations, and small mines will benefit from the requirements in the final rule. MSHA, therefore, has not exempted small mines from any provision of the final rule.

Regulatory relief is not warranted because the final rule will not impose a substantial cost increase for small mines. MSHA has determined that these provisions will not have a significantly adverse impact upon a substantial number of small entities.

*Small Business Regulatory Enforcement Fairness Act*

MSHA has determined that this final rule is not a ''major rule'' requiring prior approval by the Congress and the President under the Small Business Regulatory Enforcement Act of 1996 (5 U.S.C. § 801 *et seq.*) (SBREFA), because it is not likely to result in: (1) an annual effect on the economy of $100 million or more; (2) a major increase in costs or prices for consumers, individual industries, federal, state, or local government agencies, or geographic regions; or (3) significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of United States-based enterprises to compete with foreign enterprises in domestic and export markets.

The Agency will send copies of the final rule, preamble, and regulatory flexibility analysis to the President of the Senate, the Speaker of the House, and the General Counsel of the General Accounting Office.

V. Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995, Pub.L. 104–4, requires each federal agency to assess the effects of federal regulatory actions on state, local, and tribal governments and the private sector, other than to the extent such actions merely incorporate requirements specifically set forth in a statute. For purposes of the Unfunded Mandates Reform Act of 1995, as well as E.O. 12875, this rule does not include any federal mandate that may result in increased expenditures by either State, local, and tribal governments, or increased expenditures by the private sector of more than $100 million on the private sector.

VI. Electronic Availability of Rulemaking Documents

Electronic copies of the preamble and final rule, and the Regulatory Impact Analysis and Regulatory Flexibility Analysis are available on the Internet at the U.S. Department of Labor, Mine Safety and Health Administration's World Wide Web home page at http://www.msha.gov. Instructions for accessing regulatory documents and information are as follows:

From MSHA's home page select the menu item entitled ''Statutory and Regulatory Information.'' This will direct the search to the Statutory and Regulatory menu page. Then select the menu item entitled ''Federal Register Documents.'' This will direct the search

to the menu page for Federal Register Documents. The type of documents listed are proposed rules, final rules, meetings (Advisory Committees), Information Collection Requests, petitions for modifications, proposed policies, and miscellaneous notices. Select the menu item desired. To return to MSHA's home page, use the icon at the bottom of the page or the ''Back Button'' provided by your browser.

List of Subjects

*30 CFR Part 7*

Diesel-powered equipment, Mine safety and health, Reporting and recordkeeping requirements.

*30 CFR Parts 31 and 32*

Reporting and recordkeeping requirements, Research, Underground coal mines.

*30 CFR Part 36*

Mine safety and health.

*30 CFR Parts 70 and 75*

Diesel-powered equipment, Incorporations by reference, Mine safety and health, Underground coal mines, Reporting and recordkeeping requirements.

Dated: October 15, 1996.

J. Davitt McAteer,

*Assistant Secretary for Mine Safety and Health.*

Accordingly, chapter I of title 30, Code of Federal Regulations is amended as follows:

## PART 7—TESTING BY APPLICANT OR THIRD PARTY

1. The authority citation for part 7 continues to read as follows:

Authority: 30 U.S.C. 957.

2. New subparts E and F are added to part 7 to read as follows:

### Subpart E—Diesel Engines Intended for Use in Underground Coal Mines

Sec.



## Subpart E—Diesel Engines Intended for Use in Underground Coal Mines

### § 7.81 Purpose and effective date.

Subpart A general provisions of this part apply to this subpart E. Subpart E establishes the specific engine performance and exhaust emission requirements for MSHA approval of diesel engines for use in areas of underground coal mines where permissible electric equipment is required and areas where non-permissible electric equipment is allowed. It is effective November 25, 1996.

### § 7.82 Definitions.

In addition to subpart A definitions of this part, the following definitions apply in this subpart.

*Brake Power.* The observed power measured at the crankshaft or its equivalent when the engine is equipped only with standard auxiliaries necessary for its operation on the test bed.

*Category A engines.* Diesel engines intended for use in areas of underground coal mines where permissible electric equipment is required.

*Category B engines.* Diesel engines intended for use in areas of underground coal mines where nonpermissible electric equipment is allowed.

*Corrosion-resistant material.* Material that has at least the corrosion-resistant properties of type 304 stainless steel.

*Diesel engine.* Any compression ignition internal combustion engine using the basic diesel cycle where combustion results from the spraying of fuel into air heated by compression.

*Exhaust emission.* Any substance emitted to the atmosphere from the exhaust port of the combustion chamber of a diesel engine.

*Intermediate speed.* Maximum torque speed if it occurs between 60 percent and 75 percent of rated speed. If the maximum torque speed is less than 60 percent of rated speed, then the intermediate speed shall be 60 percent of the rated speed. If the maximum torque speed is greater than 75 percent of the rated speed, then the intermediate speed shall be 75 percent of rated speed.

*Low idle speed.* The minimum no load speed as specified by the engine manufacturer.

*Maximum torque speed.* The speed at which an engine develops maximum torque.

*Operational range.* All speed and load (including percent loads) combinations from the rated speed to the minimum permitted engine speed at full load as specified by the engine manufacturer.

*Particulates.* Any material collected on a specified filter medium after diluting exhaust gases with clean, filtered air at a temperature of less than or equal to 125° F (52° C), as measured at a point immediately upstream of the primary filter. This is primarily carbon, condensed hydrocarbons, sulfates, and associated water.

*Percent load.* The fraction of the maximum available torque at an engine speed.

*Rated horsepower.* The nominal brake power output of a diesel engine as specified by the engine manufacturer with a specified production tolerance. For laboratory test purposes, the fuel pump calibration for the rated horsepower must be set between the nominal and the maximum fuel tolerance specification.

*Rated speed.* Speed at which the rated power is delivered, as specified by the engine manufacturer.

*Steady-state condition.* Diesel engine operating condition which is at a constant speed and load and at stabilized temperatures and pressures.

*Total oxides of nitrogen.* The sum total of the measured parts per millions (ppm) of nitric oxide (NO) plus the measured ppm of nitrogen dioxide ($NO_2$).

### § 7.83 Application requirements.

(a) An application for approval of a diesel engine shall contain sufficient information to document compliance with the technical requirements of this subpart and specify whether the application is for a category A engine or category B engine.

(b) The application shall include the following engine specifications—

(1) Model number;

(2) Number of cylinders, cylinder bore diameter, piston stroke, engine displacement;

(3) Maximum recommended air inlet restriction and exhaust backpressure;

(4) Rated speed(s), rated horsepower(s) at rated speed(s), maximum torque speed, maximum rated torque, high idle, minimum permitted engine speed at full load, low idle;

(5) Fuel consumption at rated horsepower(s) and at the maximum rated torque;

(6) Fuel injection timing; and

(7) Performance specifications of turbocharger, if applicable.

(c) The application shall include dimensional drawings (including tolerances) of the following components specifying all details affecting the technical requirements of this subpart. Composite drawings specifying the required construction details may be submitted instead of individual drawings of the following components—

(1) Cylinder head;
(2) Piston;
(3) Inlet valve;
(4) Exhaust valve;
(5) Cam shaft—profile;
(6) Fuel cam shaft, if applicable;
(7) Injector body;
(8) Injector nozzle;
(9) Injection fuel pump;
(10) Governor;
(11) Turbocharger, if applicable;
(12) Aftercooler, if applicable;
(13) Valve guide;
(14) Cylinder head gasket; and
(15) Precombustion chamber, if applicable.

(d) The application shall include a drawing showing the general arrangement of the engine.

(e) All drawings shall be titled, dated, numbered, and include the latest revision number.

(f) When all necessary testing has been completed, the following information shall be submitted:

(1) The gaseous ventilation rate for the rated speed and horsepower.

(2) The particulate index for the rated speed and horsepower.

(3) A fuel deration chart for altitudes for each rated speed and horsepower.

**§ 7.84 Technical requirements.**

(a) *Fuel injection adjustment.* The fuel injection system of the engine shall be constructed so that the quantity of fuel injected can be controlled at a desired maximum value. This adjustment shall be changeable only after breaking a seal or by altering the design.

(b) *Maximum fuel-air ratio.* At the maximum fuel-air ratio determined by § 7.87 of this part, the concentrations (by volume, dry basis) of carbon monoxide (CO) and oxides of nitrogen ($NO_X$) in the undiluted exhaust gas shall not exceed the following:

(1) There shall be no more than 0.30 percent CO and no more than 0.20 percent $NO_X$ for category A engines.

(2) There shall be no more than 0.25 percent CO and no more than 0.20 percent $NO_X$ for category B engines.

*(c) Gaseous emissions ventilation rate.* Ventilation rates necessary to dilute gaseous exhaust emissions to the following values shall be determined under § 7.88 of this part:

| | |
|---|---|
| Carbon dioxide | −5000 ppm |
| Carbon monoxide | −50 ppm |
| Nitric oxide | −25 ppm |
| Nitrogen dioxide | −5 ppm |

A gaseous ventilation rate shall be determined for each requested speed and horsepower rating as described in § 7.88(b) of this part.

(d) *Fuel deration.* The fuel rates specified in the fuel deration chart shall be based on the tests conducted under paragraphs (b) and (c) of this section and shall ensure that the maximum fuel:air (f/a) ratio determined under paragraph (b) of this section is not exceeded at the altitudes specified in the fuel deration chart.

(e) *Particulate index.* For each rated speed and horsepower requested, the particulate index necessary to dilute the exhaust particulate emissions to 1 mg/$m^3$ shall be determined under § 7.89 of this part.

**§ 7.85 Critical characteristics.**

The following critical characteristics shall be inspected or tested on each diesel engine to which an approval marking is affixed—

(a) Fuel rate is set properly; and

(b) Fuel injection pump adjustment is sealed, if applicable.

**§ 7.86 Test equipment and specifications.**

(a) Dynamometer test cell shall be used in determining the maximum f/a ratio, gaseous ventilation rates, and the particulate index.

(1) The following testing devices shall be provided:

(i) An apparatus for measuring torque that provides an accuracy of ±2.0 percent based on the engine's maximum value;

(ii) An apparatus for measuring revolutions per minute (rpm) that provides an accuracy of ±2.0 percent based on the engine's maximum value;

(iii) An apparatus for measuring temperature that provides an accuracy of ±4° F (2° C) of the absolute value except for the exhaust gas temperature device that provides an accuracy of ±27° F (15° C);

(iv) An apparatus for measuring intake and exhaust restriction pressures that provides an accuracy of ±5 percent of maximum;

(v) An apparatus for measuring atmospheric pressure that provides an accuracy of ±0.5 percent of reading;

(vi) An apparatus for measuring fuel flow that provides an accuracy of ±2 percent based on the engine's maximum value;

(vii) An apparatus for measuring the inlet air flow rate of the diesel engine that provides an accuracy of ±2 percent based on the engine's maximum value; and

(viii) For testing category A engines, an apparatus for metering in 1.0 ±0.1 percent, by volume, of methane ($CH_4$) into the intake air system shall be provided.

(2) The test fuel specified in Table E–1 shall be a low volatile hydrocarbon fuel commercially designated as ''Type 2–D'' grade diesel fuel. The fuel may contain nonmetallic additives as follows: Cetane improver, metal deactivator, antioxidant, dehazer, antirust, pour depressant, dye, dispersant, and biocide.

TABLE E–1.—DIESEL TEST FUEL SPECIFICATIONS

| Item | ASTM | Type 2–D |
|---|---|---|
| Cetane number | D613 | 40–48. |
| Cetane index | D976 | 40–48. |
| Distillation range: | | |
| IBP °F | D86 | 340–400. |
| (°C) | | (171.1–204.4). |
| 10 pct. point, °F | D86 | 400–460. |
| (°C) | | (204.4–237.8). |
| 50 pct. point, °F | D86 | 470.540. |
| (°C) | | (243.3–282.2). |
| 90 pct. point, °F | D86 | 560–630. |
| (°C) | | (293.3–332.2). |
| EP, °F | D86 | 610–690. |
| (°C) | | (321.1–365.6). |
| Gravity, °API | D287 | 32–37. |
| Total sulfur, pct. | D2622 | 0.03–0.05. |
| Hydrocarbon composition: | | |
| Aromatics, pct. | D1319 | 27 minimum. |
| Paraffins, naphthenes, olefins | D1319 | Remainder. |

TABLE E–1.—DIESEL TEST FUEL SPECIFICATIONS—Continued

| Item | ASTM | Type 2–D |
|---|---|---|
| Flashpoint, minimum, °F | 93 | 130. |
| (°C) | | (54.4). |
| Viscosity, centistokes | 445 | 2.0–3.2. |

(3) The test fuel temperature at the inlet to the diesel engine's fuel injection pump shall be controlled to the engine manufacturer's specification.

(4) The engine coolant temperature (if applicable) shall be maintained at normal operating temperatures as specified by the engine manufacturer.

(5) The charge air temperature and cooler pressure drop (if applicable) shall be set to within ±7° F(4° C) and ±0.59 inches Hg (2kPa) respectively, of the manufacturer's specification.

(b) Gaseous emission sampling system shall be used in determining the gaseous ventilation rates.

(1) The schematic of the gaseous sampling system shown in Figure E–1 shall be used for testing category A engines. Various configurations of Figure E–1 may produce equivalent results. The components in Figure E–1 are designated as follows—

(i) Filters—F1, F2, F3, and F4;

(ii) Flowmeters—FL1, FL2, FL3, FL4, FL5, FL6, and FL7;

(iii) Upstream Gauges—G1, G2, and G5;

(iv) Downstream Gauges—G3, G4, and G6;

(v) Pressure Gauges—P1, P2, P3, P4, P5, and P6;

(vi) Regulators—R1, R2, R3, R4, R5, R6, and R7;

(vii) Selector Valves—V1, V2, V3, V4, V6, V7, V8, V15, and V19;

(viii) Heated Selector Valves—V5, V13, V16, and V17;

(ix) Flow Control Valves—V9, V10, V11 and V12;

(x) Heated Flow Control Valves—V14 and V18;

(xi) Pump—Sample Transfer Pump;

(xii) Temperature Sensor—(T1);

(xiii) Dryer—D1 and D2; and

(xiv) Water traps—WT1 and WT2.

(A) Water removal from the sample shall be done by condensation.

(B) The sample gas temperature or dew point shall be monitored either within the water trap or downstream of the water trap and shall not exceed 45° F (7° C).

(C) Chemical dryers are not permitted.

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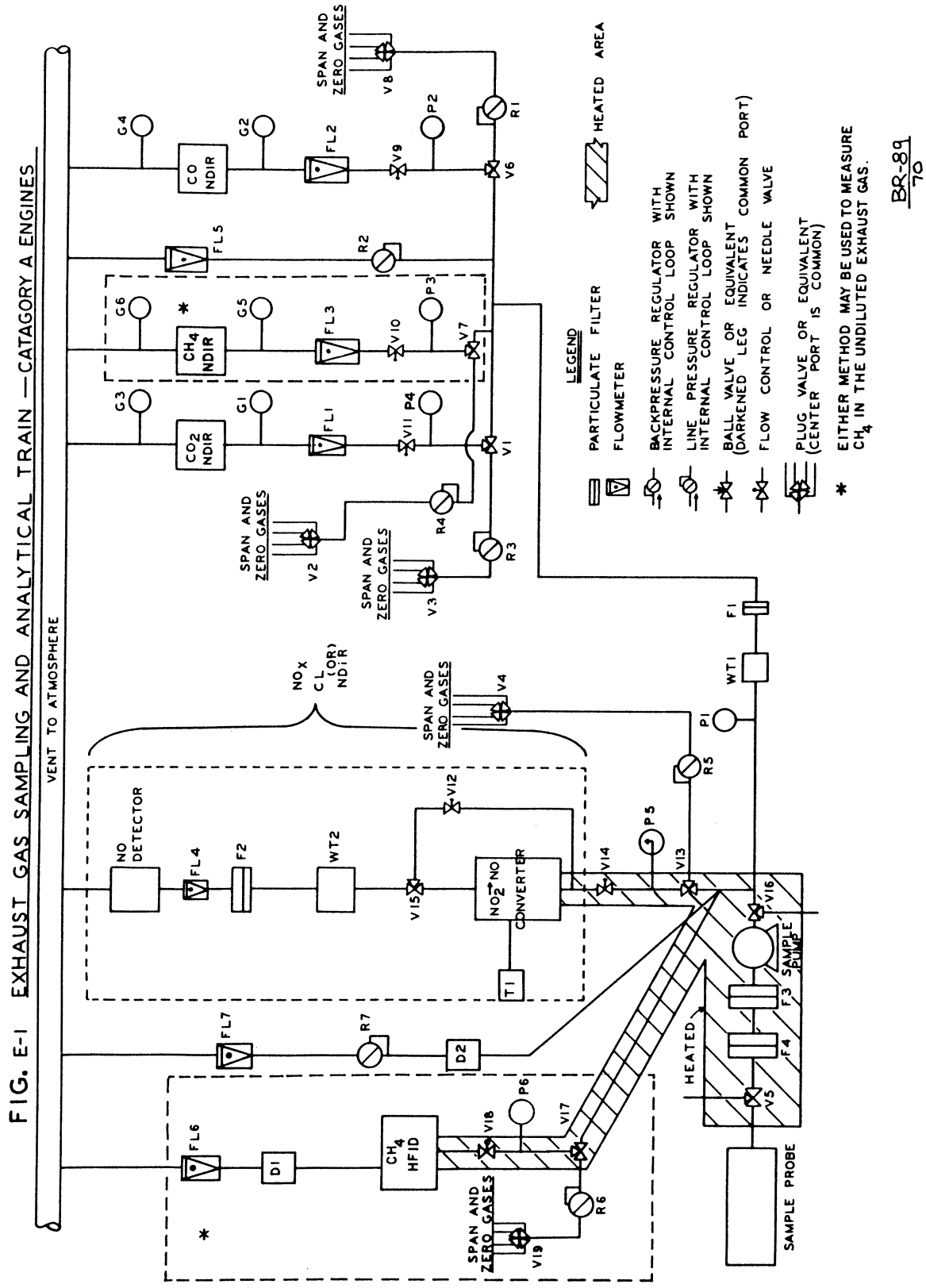


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(2) The schematic of the gaseous sampling system shown in Figure E–2 shall be used for testing category B engines. Various configurations of Figure E–2 may produce equivalent results. The components are designated as follows—

(i) Filters—F1, F2, F3, and F4;

(ii) Flowmeters—FL1, FL2, FL3, and FL4;

(iii) Upstream Gauges—G1, and G2;

(iv) Downstream Gauges—G3, and G4;

(v) Pressure Gauges—P1, P2, P3, and P4;

(vi) Regulators—R1, R2, R3, and R4;

(vii) Selector Valves—V1, V2, V3, V4, V6, and V7;

(viii) Heated Selector Valves—V5, V8, and V12;

(ix) Flow Control Valves—V9, V10, V11;

(x) Heated Flow Control Valves—V13;

(xi) Pump—Sample Transfer Pump;

(xii) Temperature Sensor—(T1); and

(xiii) Water traps—WT1 and WT2.

(A) Water removal from the sample shall be done by condensation.

(B) The sample gas temperature or dew point shall be monitored either within the water trap or downstream of the water trap and shall not exceed 45 °F (7 °C).

(C) Chemical dryers are not permitted.

(3) All components or parts of components that are in contact with the sample gas or corrosive calibration gases shall be corrosion-resistant material.

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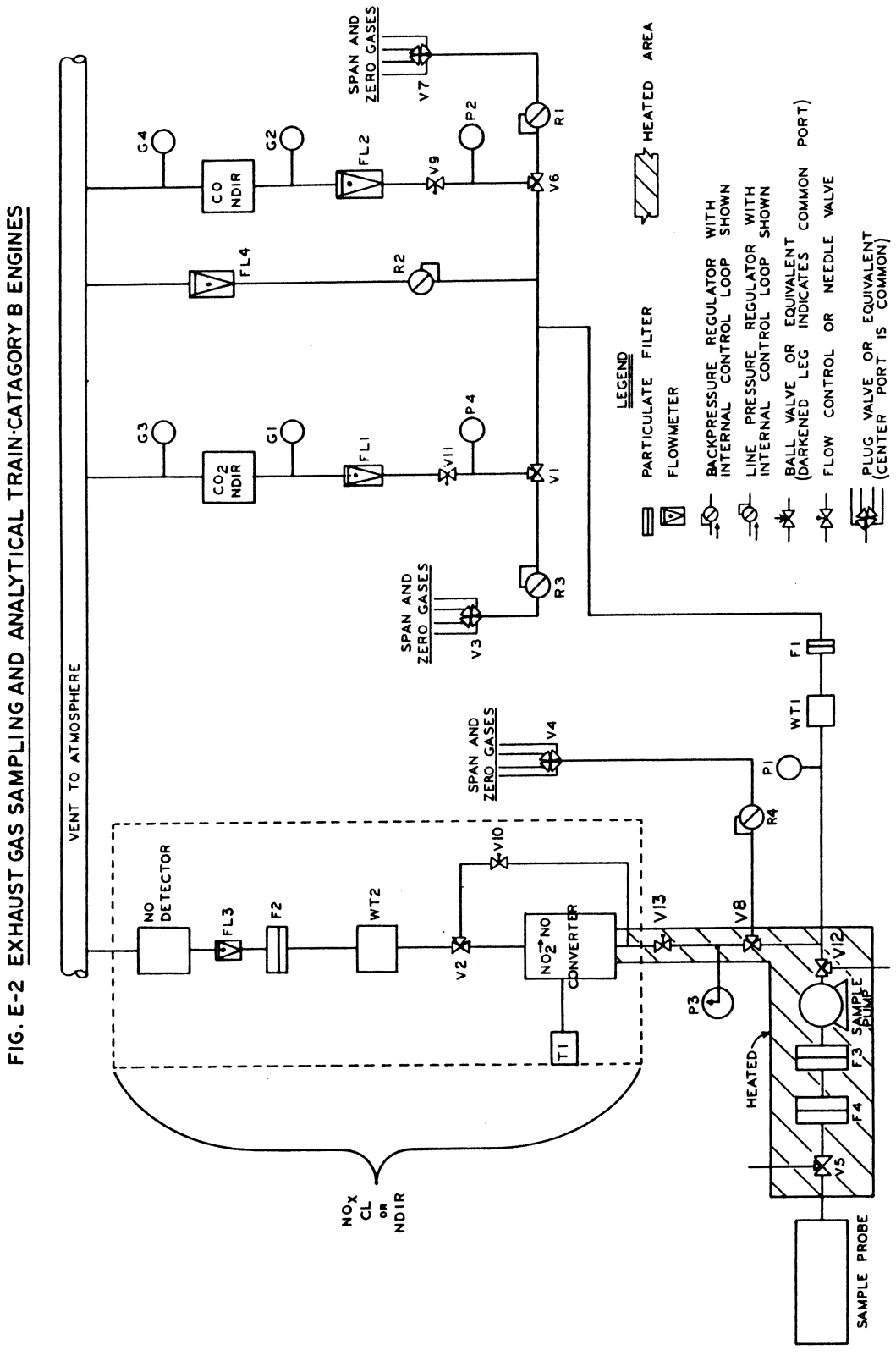
FIG. E-2 EXHAUST GAS SAMPLING AND ANALYTICAL TRAIN-CATAGORY B ENGINES

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(4) All analyzers shall obtain the sample to be analyzed from the same sample probe.

(5) CO and $CO_2$ measurements shall be made on a dry basis.

(6) Calibration or span gases for the $NO_X$ measurement system shall pass through the $NO_2$ to NO converter.

(7) A stainless steel sample probe shall be straight, closed-end, multi-holed, and shall be placed inside the exhaust pipe.

(i) The probe length shall be at least 80 percent of the diameter of the exhaust pipe.

(ii) The inside diameter of the sample probe shall not be greater than the inside diameter of the sample line.

(iii) The heated sample line shall have a 0.197 inch (5 mm) minimum and a 0.53 inch (13.5 mm) maximum inside diameter.

(iv) The wall thickness of the probe shall not be greater than 0.040 inch (1 mm).

(v) There shall be a minimum of 3 holes in 3 different radial planes sized to sample approximately the same flow.

(8) The sample probe shall be located in the exhaust pipe at a minimum distance of 1.6 feet (0.5 meters) or 3 times the diameter of the exhaust pipe, whichever is the larger, from the exhaust manifold outlet flange or the outlet of the turbocharger. The exhaust gas temperature at the sample probe shall be a minimum of 158° F (70° C).

(9) The maximum allowable leakage rate on the vacuum side of the analyzer pump shall be 0.5 percent of the in-use flow rate for the portion of the system being checked.

(10) *General analyzer specifications.*

(i) The total measurement error, including the cross sensitivity to other gases, (paragraphs (b)(11)(ii), (b)(12)(iii), (b)(13)(iii), and (b)(13)(iv) of this section), shall not exceed ±5 percent of the reading or ±3.5 percent of full scale, whichever is smaller. For concentrations of less than 100 ppm the measurement error shall not exceed ±4 ppm.

(ii) The repeatability, defined as 2.5 times the standard deviation of 10 repetitive responses to a given calibration or span gas, must be no greater than ±1 percent of full scale concentration for each range used above 155 parts per million (ppm) or parts per million equivalent carbon (ppmC) or ±2 percent of each range used below 155 ppm (or ppmC).

(iii) The analyzer peak to peak response to zero and calibration or span gases over any 10 second period shall not exceed 2 percent of full scale on all ranges used.

(iv) The analyzer zero drift during a 1-hour period shall be less than 2 percent of full scale on the lowest range used. The zero-response is the mean response, including noise, to a zero gas during a 30-second time interval.

(v) The analyzer span drift during a 1-hour period shall be less than 2 percent of full scale on the lowest range used. The analyzer span is defined as the difference between the span response and the zero response. The span response is the mean response, including noise, to a span gas during a 30-second time interval.

(11) *CO and $CO_2$* analyzer specifications.

(i) Measurements shall be made with nondispersive infrared (NDIR) analyzers.

(ii) For the CO analyzer, the water and $CO_2$ interference shall be less than 1 percent of full scale for ranges equal to or greater than 300 ppm (3 ppm for ranges below 300 ppm) when a $CO_2$ span gas concentration of 80 percent to 100 percent of full scale of the maximum operating range used during testing is bubbled through water at room temperature.

(12) For $NO_X$ analysis using a chemiluminescence (CL) analyzer the following parameters shall apply:

(i) From the sample point to the $NO_2$ to NO converter, the $NO_X$ sample shall be maintained between 131° F (55° C) and 392° F (200° C).

(ii) The $NO_2$ to NO converter efficiency shall be at least 90 percent.

(iii) The quench interference from $CO_2$ and water vapor must be less than 3.0 percent.

(13) For $NO_X$ analysis using an NDIR analyzer system the following parameters shall apply:

(i) The system shall include a $NO_2$ to NO converter, a water trap, and a NDIR analyzer.

(ii) From the sample point to the $NO_2$ to NO converter, the $NO_X$ sample shall be maintained between 131° F (55° C) and 392° F (200° C).

(iii) The minimum water rejection ratio (maximum water interference) for the $NO_X$ NDIR analyzer shall be 5,000:1.

(iv) The minimum $CO_2$ rejection ratio (maximum $CO_2$ interference) for the $NO_X$ NDIR analyzer shall be 30,000:1.

(14) When $CH_4$ is measured using a heated flame ionization detector (HFID) the following shall apply:

(i) The analyzer shall be equipped with a constant temperature oven that houses the detector and sample-handling components.

(ii) The detector, oven, and sample-handling components shall be suitable for continuous operation at temperatures of 374° F (190° C) ± 18° F (10° C).

(iii) The analyzer fuel shall contain 40 ± 2 percent hydrogen. The balance shall be helium. The mixture shall contain ≤ 1 part per million equivalent carbon (ppmC), and ≤ 400 ppm CO.

(iv) The burner air shall contain < 2 ppmC hydrocarbon.

(v) The percent of oxygen interference shall be less than 5 percent.

(15) An NDIR analyzer for measuring $CH_4$ may be used in place of the HFID specified in paragraph (b)(14) of this section and shall conform to the requirements of paragraph (b)(10) of this section. Methane measurements shall be made on a dry basis.

(16) Calibration gas values shall be traceable to the National Institute for Standards and Testing (NIST), ''Standard Reference Materials'' (SRM's). The analytical accuracy of the calibration gas values shall be within 2.0 percent of NIST gas standards.

(17) Span gas values shall be traceable to NIST SRM's. The analytical accuracy of the span gas values shall be within 2.0 percent of NIST gas standards.

(18) Calibration or span gases for the CO and $CO_2$ analyzers shall have purified nitrogen as a diluent. Calibration or span gases for the $CH_4$ analyzer shall be $CH_4$ with purified synthetic air or purified nitrogen as diluent.

(19) Calibration or span gases for the $NO_X$ analyzer shall be NO with a maximum $NO_2$ concentration of 5 percent of the NO content. Purified nitrogen shall be the diluent.

(20) Zero-grade gases for the CO, $CO_2$, $CH_4$ , and $NO_X$ analyzers shall be either purified synthetic air or purified nitrogen.

(21) The allowable zero-grade gas (purified synthetic air or purified nitrogen) impurity concentrations shall not exceed ≤ 1ppm C, ≤ 1 ppm CO, ≤ 400 ppm $CO_2$, and ≤ 0.1 ppm NO.

(22) The calibration and span gases may also be obtained by means of a gas divider. The accuracy of the mixing device must be such that the concentration of the diluted calibration gases are within 2 percent.

(c) Particulate sampling system shall be used in determining the particulate index. A schematic of a full flow (single dilution) particulate sampling system for testing under this subpart is shown in Figures E–3 and E–4.

(1) The dilution system shall meet the following parameters:

(i) Either a positive displacement pump (PDP) or a critical flow venturi (CFV) shall be used as the pump/mass measurement device shown in Figure E–3.

(ii) The total volume of the mixture of exhaust and dilution air shall be measured.

(iii) All parts of the system from the exhaust pipe up to the filter holder, which are in contact with raw and diluted exhaust gas, shall be designed to minimize deposition or alteration of the particulate.

(iv) All parts shall be made of electrically conductive materials that do not react with exhaust gas components.

(v) All parts shall be electrically grounded to prevent electrostatic effects.

(vi) Systems other than full flow systems may also be used provided they yield equivalent results where:

(A) A seven sample pair (or larger) correlation study between the system under consideration and a full flow dilution system shall be run concurrently.

(B) Correlation testing is to be performed at the same laboratory, test cell, and on the same engine.

(C) The equivalency criterion is defined as a ± 5 percent agreement of the sample pair averages.

(2) The mass of particulate in the exhaust shall be collected by filtration. The exhaust temperature immediately before the primary particulate filter shall not exceed 125° F (52.0° C).

(3) Exhaust system backpressure shall not be artificially lowered by the PDP, CFV systems or dilution air inlet system. Static exhaust backpressure measured with the PDP or CFV system operating shall remain within ± 0.44 inches Hg (1.5 kPa) of the static pressure measured without being connected to the PDP or CFV at identical engine speed and load.

(4) The gas mixture temperature shall be measured at a point immediately ahead of the pump or mass measurement device.

(i) Using PDP, the gas mixture temperature shall be maintained within ± 10° F (6.0° C) of the average operating temperature observed during the test, when no flow compensation is used.

(ii) Flow compensation can be used provided that the temperature at the inlet to the PDP does not exceed 122° F (50° C).

(iii) Using CFV, the gas mixture temperature shall be maintained within ± 20° F (11° C) of the average operating temperature observed during the test, when no flow compensation is used.

(5) The heat exchanger shall be of sufficient capacity to maintain the temperature within the limits required above and is optional if electronic flow compensation is used.

(6) When the temperature at the inlet of either the PDP or CFV exceeds the limits stated in either paragraphs (c)(4)(i) or (c)(4)(iii) of this section, an electronic flow compensation system shall be required for continuous measurement of the flow rate and control of the proportional sampling in the particulate sampling system.

(7) The flow capacity of the system shall be large enough to eliminate water condensation.

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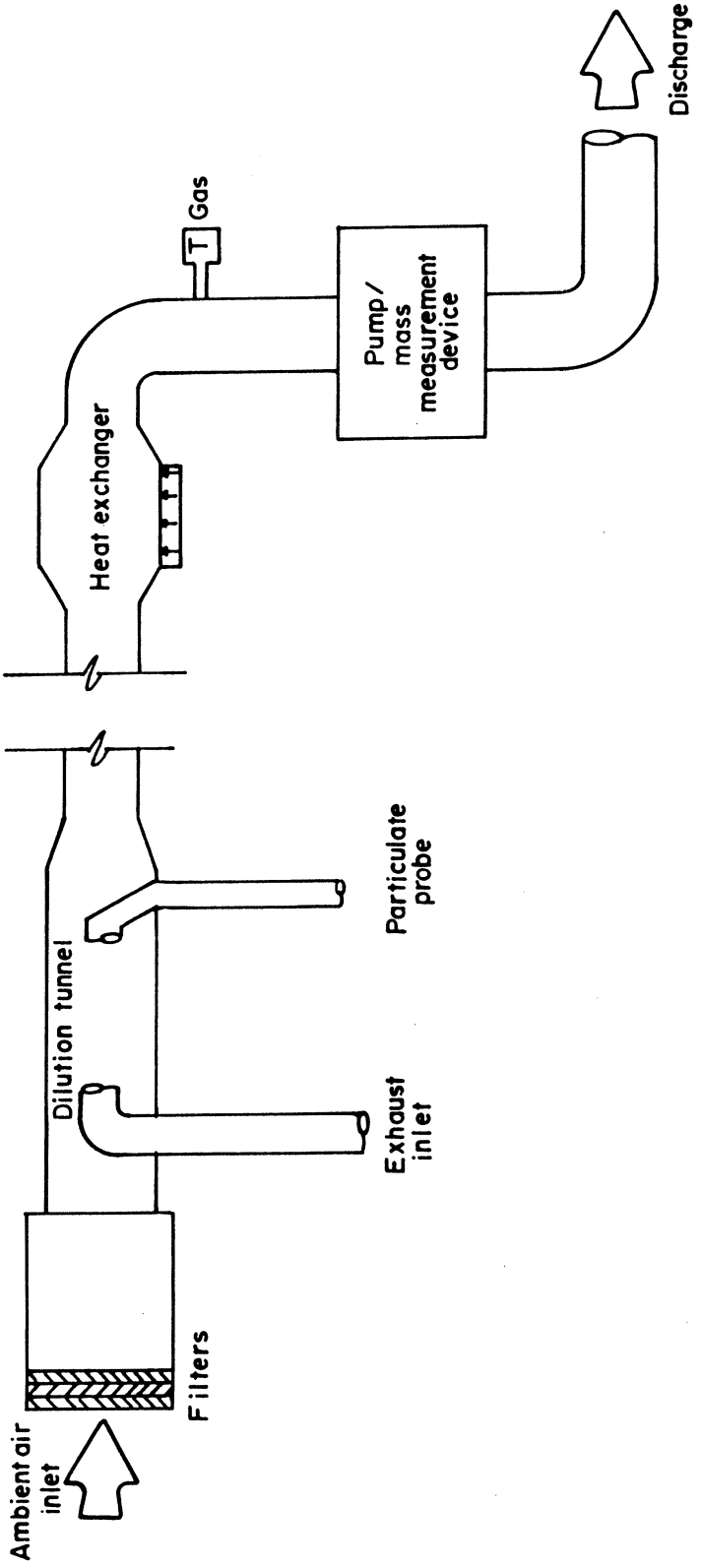


FIG. E-3 DILUTION TUNNEL/CONSTANT VOLUME SYSTEM

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